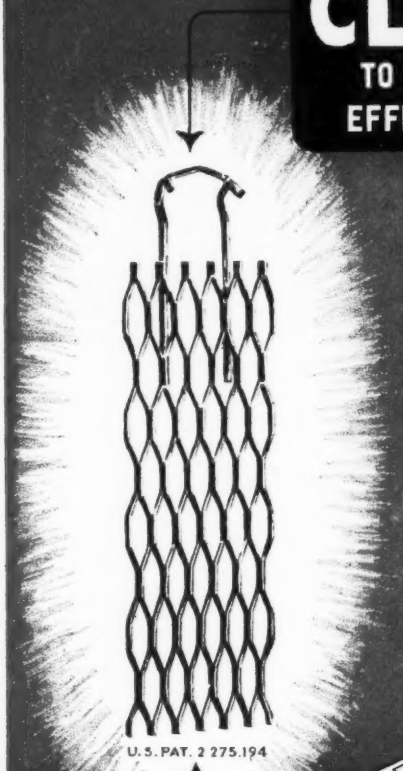
THE MONTHLY

Review

MARCH • • • 1947

CLEPANODES

TO SPEED ACTION AND IMPROVE EFFICIENCY OF ELECTROCLEANERS



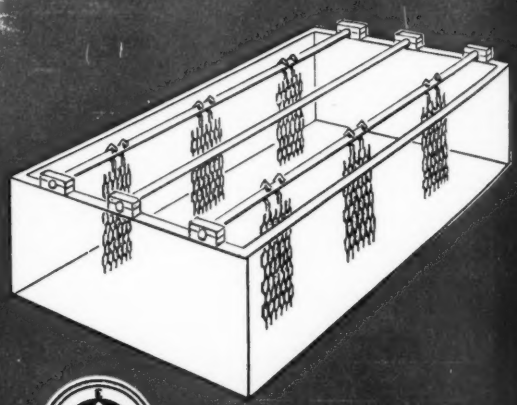
U.S. PAT. 2 275 194

The Clepanodes are made of Steel with Bronze Hooks. The design is of a special patented nature which gives improved current carrying capacity and increased gas dislodgement action.

The result is that more mechanical gas scrubbing action is obtained on the work being electrocleaned. Therefore the work will electroclean much faster and much more uniformly.

These Clepanodes are ideal for use in Electrocleaners prior to Bright Nickel Plating, Cadmium, Zinc, Brass, etc.

Install Clepanodes immediately in your Electrocleaning tanks.



CLEPANODES ARE AVAILABLE IN TWO SIZES

① 24" Grid + 4" Hook = 28" overall height. Total Net W. 12 lbs.

② 32" Grid + 4" Hook = 36" overall height. Total Net W. 16 lbs.

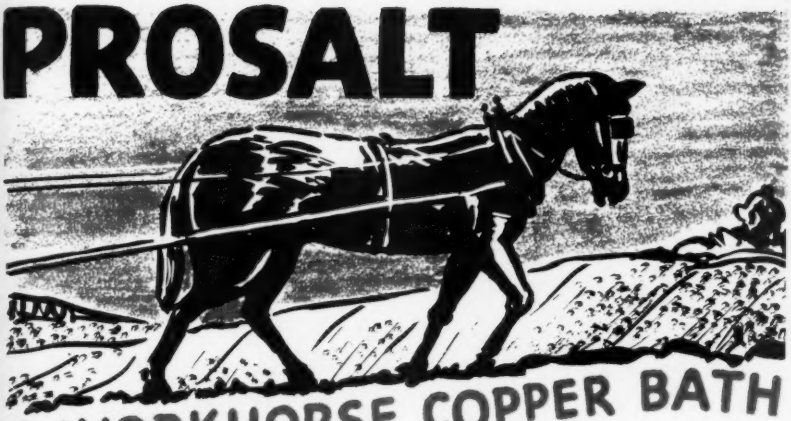
All Clepanodes are 8" overall in width.

CLEANING COMPOUNDS

FREDERICK GUMM Chemical Company Inc.

538-542 Forest St., Kearny, N. J.

PROSALT



A WORKHORSE COPPER BATH

Top Quality at Lower Cost!

PROSALT is a liquid addition agent for a copper cyanide bath used with direct current.

This PROMAT QUALITY product has many advantages—BROADER operating range; LOWER optimum temperature; Fine grained, lighter color, more ductile deposits. Existing Rochelle baths may also be converted by the addition of 130 cc. Prosalt per gallon.

Make-Up Analysis Prosalt Copper Bath	Cost
Copper cyanide, 3.5 ounces per gallon	$0.0764
Sodium cyanide, 4.6 ounces per gallon	0.049
Sodium carbonate, 4.0 ounces per gallon	0.0075
PROSALT, 130 cc. per gallon	0.184
	$0.3169 per gallon

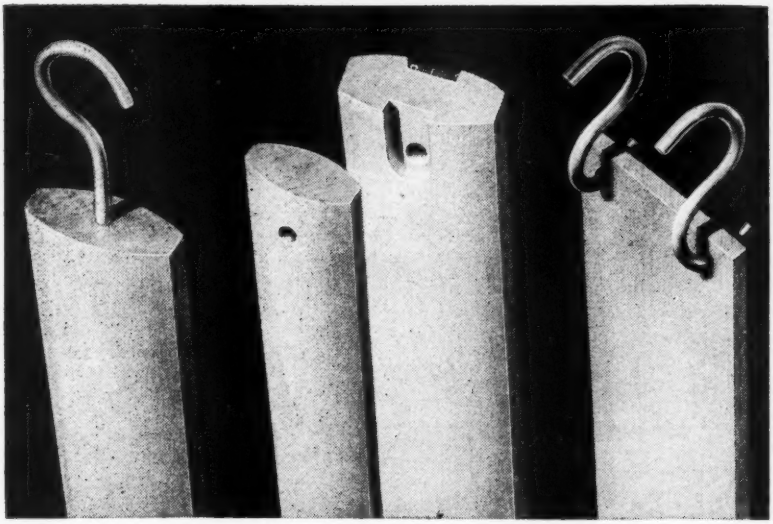
PROSALT aids the cathode efficiency and you can expect deposits in the neighborhood of three-quarters of one thousandths in twenty minutes at forty amperes per square foot. The character of the deposit will be excellent for buffing and for stop-off for heat treatment and the color will be "lighter" than that obtained from a Rochelle bath. Adherence of the deposit will be excellent. The deposits on polished steel surfaces will be sufficiently bright to accept bright nickel immediately. Also, there will be no rinsing problem after PROSALT deposits.

PROSALT available f.o.b. Waukegan, Illinois, in twelve gallon carboys at $5.35 per gallon.

Representatives in principal cities. Write to

PROMAT DIVISION—Poor & Company

851 SOUTH MARKET STREET WAUKEGAN, ILLINOIS



Anaconda means Purity in Copper Anodes

WHEN YOU SPECIFY ANACONDA, you are assured of unexcelled purity... less than 0.01 percent of total metallic impurities... an advantage that pays off five ways:

1. **Copper goes into solution faster and more uniformly.**
2. **The highest quality deposit is produced in the shortest possible time.**
3. **Slime is reduced to an absolute minimum.**
4. **Spotting and discoloration of the deposit are minimized.**
5. **Scrap losses are exceptionally low.**

In addition to copper, Anaconda Anodes are furnished in brass and bronze... rolled Sheet or Oval... cut to your own specifications or standard sizes... drilled or undrilled... with or without hooks—also "cathode-anodes." For present or future reference, write for Publication C-5. 47272

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

Interlocking Grains

Answer to the Loose Nickel Nuisance

LOOSE nickel in high acid or low pH baths results from intercrystalline corrosion, which isolates the grains before they can dissolve. This is practically eliminated by the spoke-like grain of "Seycast" 99%+ Pure Cast Nickel Anodes.

The long, narrow grains extend to a common center, (see above). As acid can penetrate but a short distance, the grains tend to remain firmly in place during entire corrosion process.

The envelope formed during corrosion is soft, the sludge per pound of anode extremely small, and the particle size too large to penetrate the bag. This assures protection against rough plate in high current density baths. Full details on request.

SEYMOUR

"Seycast"

NICKEL ANODES

The Seymour Mfg. Co., Seymour, Conn.

NON-FERROUS ALLOYS Since 1878

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POLISHING, BUFFING, COLORING, and DEBURRING COMPOSITIONS.
you can rest assured that it carries a two-fold guarantee of extra quality . . . laboratory control of raw materials —combined in proper percentages and tested under actual working conditions to assure the best obtainable results in your finishing operations.
There is a Stevens Composition especially developed for use on all types of mechanical or hand buffing operations —"precision" materials, exactly uniform in formula, texture and quality. For better all-around results, use a composition bearing the Stevens trademark.
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(Steric Acid Base) for
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THE MONTHLY

Review

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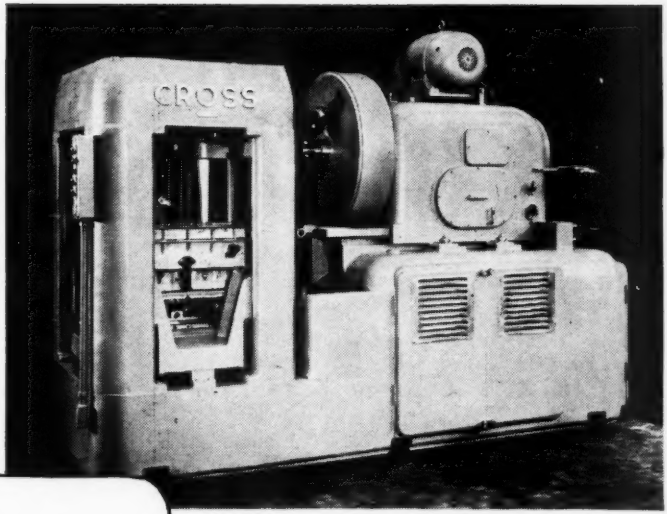

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WITH DU PONT CHEMICALS AND PROCESSES

DUPONT "ZIN-O-LYTE" *Zinc Plating* — *zinc deposits direct from the bath without bright dipping!*

DUPONT "DUROBRITE" *Zinc Plating* — *pure zinc on steel surfaces of almost any size or shape!*

DUPONT "ZIN-O-LYTE" Zinc Plating

zinc deposits direct from the bath without bright dipping!

- high operating efficiency at both high and low current densities.
- baths easily made up from prepared salts.
- suitable for all types of zinc plating, particularly barrel plating.
- satisfactory for use with almost any types of ferrous metals.

DUPONT "DUROBRITE" Zinc Plating

pure zinc on steel surfaces of almost any size or shape!

- low in cost.
- bath made up easily from standard chemicals.
- easy to operate and control—gives good results under a wide range of operating conditions.
- rapid rate of deposition with high allowable current density.

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RATINGS

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The Selenium Rectifier is an IT&T development, pioneered and perfected in this country by Federal. And Federal rectifiers have given years of outstanding service with all types of equipment in all branches of industry — every unit backed by many years of experience in design and manufacture.

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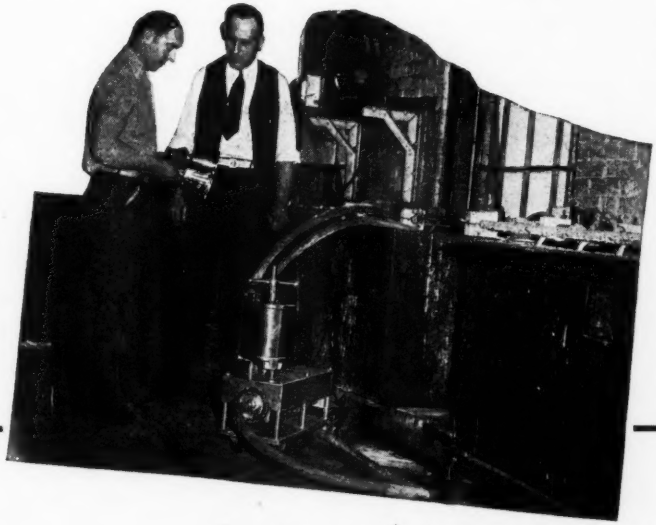

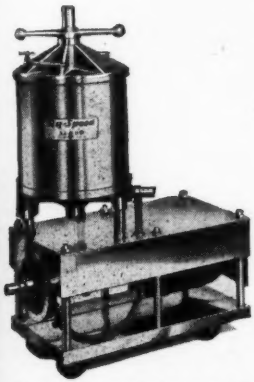

Note how splash-proof stand completely protects motor and pump from damage caused by the spilling of corrosive liquids. This compact filter complete as shown requires very little floor space. Filtering powders or slurry mixing tanks, are not needed.

Put an end to costly rejects and reworking once and for all. To remove dust, dirt, oil and sludge from your plating solution and then keep it bright and clean—use a filter that actually eliminates impurities down to the millionth part of an inch—Alsop's "*Sealed-Disc*" Filter.

Platers who depend on "*Sealed-Disc*" Filters no longer worry about pitting, spotting, poor adhesion, formation of nodules, etc., they get more perfectly finished work with a saving of time and labor.

If you plate in variety or volume, this "*Sealed-Disc*" Filter offers you many advantages. We'll be glad to give you all the facts, or if you prefer, just contact your regular plating supplier.

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Continuous or Intermittent Operation

SPARKLER HORIZONTAL PLATE FILTERS

★ ★ ★ ★ ★

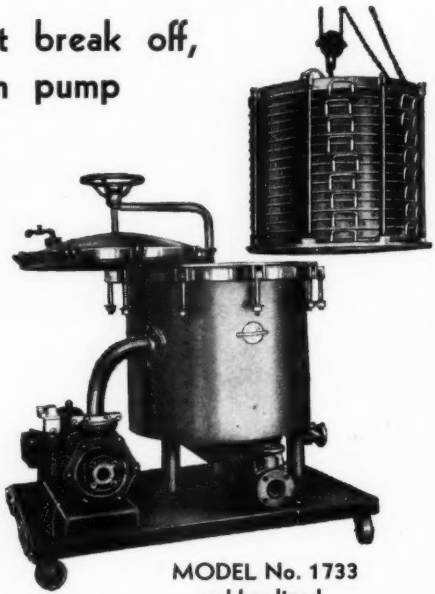
cake will not break off, crumble when pump is stopped.

4 special models *for* plating solutions—

RUBBER-LINED (see cut)
STAINLESS STEEL
ALL-STEEL
ALL-IRON

also other constructions

- compact unit shown occupies 46″ x 66″
- use either powder or pads
- quick and easy to clean
- capacities 60 to 10,000 GPH



MODEL No. 1733
rubber-lined
capacity 5,000 GPH

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PRESSURE-TIGHT AND LEAKPROOF
AMPLE CAKE SPACE FOR CARBON TREATMENT
LOW COST OPERATION

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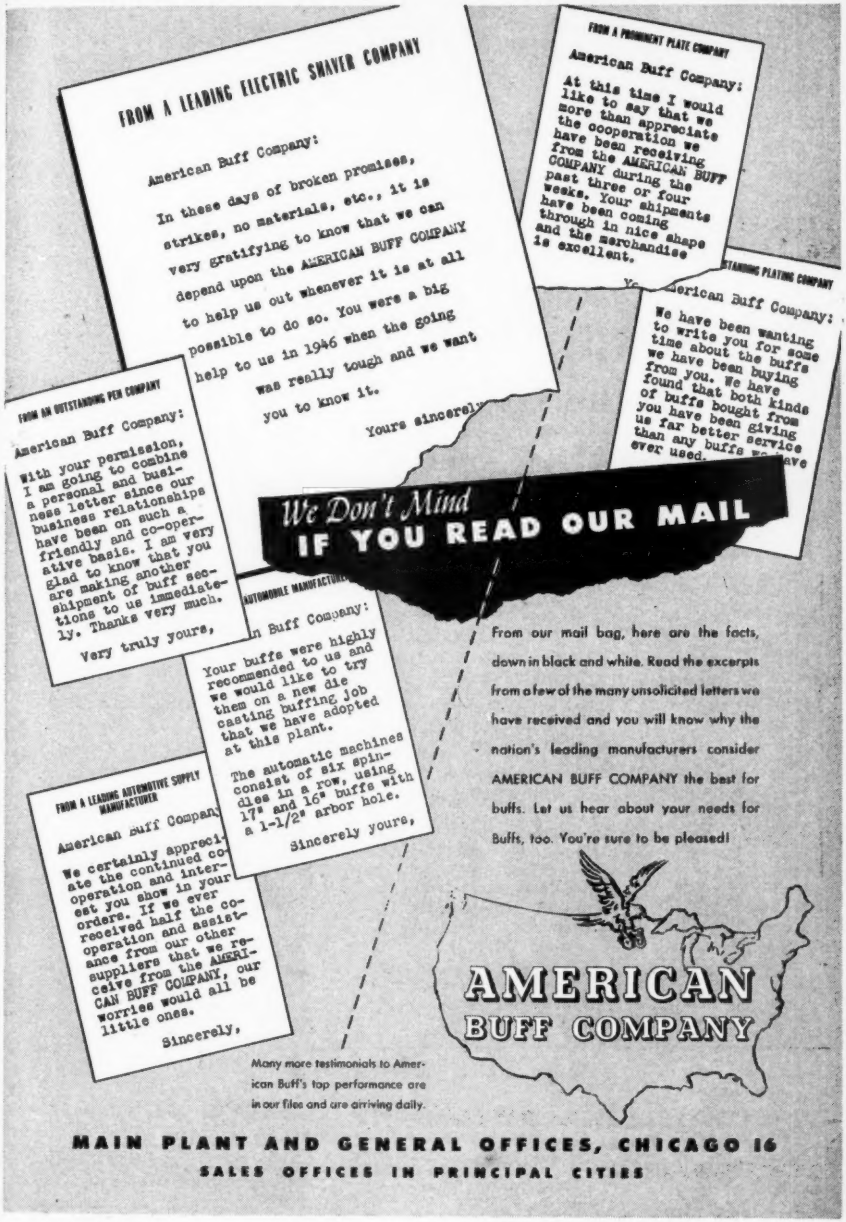
FROM A LEADING ELECTRIC SHAVER COMPANY
American Buff Company:
In these days of broken promises, strikes, no materials, etc., it is very gratifying to know that we can depend upon the AMERICAN BUFF COMPANY to help us out whenever it is at all possible to do so. You were a big help to us in 1946 when the going was really tough and we want you to know it.
Yours sincerely
FROM A PROMINENT PLATE COMPANY
American Buff Company:
At this time I would like to say that we more than appreciate the cooperation we have been receiving from the AMERICAN BUFF COMPANY during the past three or four weeks. Your shipments have been coming through in nice shape and the merchandise is excellent.
Yours
FROM AN OUTSTANDING PCR COMPANY
American Buff Company:
With your permission, I am going to combine a personal and business letter since our business relationships have been on such a friendly and co-operative basis. I am very glad to know that you are making another shipment of buff sections to us immediately. Thanks very much.
Very truly yours,
STANDING PLATING COMPANY
American Buff Company:
We have been wanting to write you for some time about the buffs we have been buying from you. We have found that both kinds of buffs bought from you have been giving us far better service than any buffs we ever used.
AUTOMOBILE MANUFACTURER
n Buff Company:
Your buffs were highly recommended to us and we would like to try them on a new die casting buffing job that we have adopted at this plant.
The automatic machines consist of six spindles in a row, using 17" and 16" buffs with a 1-1/2" arbor hole.
Sincerely yours,
FROM A LEADING AUTOMOTIVE SUPPLY MANUFACTURER
American Buff Company
We certainly appreciate the continued cooperation and interest you show in your orders. If we ever received half the cooperation and assistance from our other suppliers that we receive from the AMERICAN BUFF COMPANY, our worries would all be little ones.
Sincerely,
We Don't Mind
IF YOU READ OUR MAIL
From our mail bag, here are the facts, down in black and white. Read the excerpts from a few of the many unsolicited letters we have received and you will know why the nation's leading manufacturers consider AMERICAN BUFF COMPANY the best for buffs. Let us hear about your needs for Buffs, too. You're sure to be pleased!
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Many more testimonials to American Buff's top performance are in our files and are arriving daily.
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MURAC — inhibited acid cleaning and descaling compound—does not attack base metal noticeably.

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- *For Aluminum* — AE - PC - LIXOL
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- *Non-clogging steam jenny cleaner* — GM
- *Wire coating compound* — WC
- *All purpose stripper* — ST

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Start with a *Good Finish*

Cleaning Compounds formulated by The Puritan Manufacturing Company provide platers with the necessary requirements for satisfactory plating. PURICO Compounds eliminate superfluous operations . . . save time and labor . . . minimize rejections . . . speeds up production.

A pre-saponified Tripoli bar composition for economical buffing. Soluble in mild alkali, Wonderbar rinses from intricate patterns without requiring degreasing machines. *Makes tedious manual scrubbing unnecessary.*

Solves the tough and complex burring problem. Applied to the wheel, Pur-Bur is self-lubricating to prevent friction, embrittlement, or burned surfaces. Possesses high cutting qualities for rapid removal of burrs and fins without dangerous results.

A black oxide finish that provides a lustrous black, long-lasting finish on Zinc products. Penetrates directly into the metal to eliminate the danger of chipping or flaking.

THE *Puritan*
MANUFACTURING COMPANY
WATERBURY, CONNECTICUT

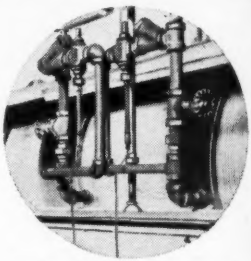
Both heating and cooling of degreaser solvent are made automatic with Sarco VL Vapor Line control and TR-40 cooling control.

Metal Washing TEMPERATURE CONTROLS

When plating and other processes requiring metal washing or cleaning became streamlined and automatic, the need for reliable temperature control became obvious.

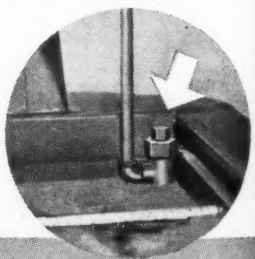
On this page, we illustrate four different Sarco controls used for this purpose. Each is positive in action, simple in construction and relatively low in cost.

Many manufacturers of washing and degreasing equipment install Sarco control as part of the machine, but it is easily added on existing equipment.



Two Sarco type TR-21 temperature regulators controlling barrel type cleaning machine.

For approximate control on cleaning and rinsing tanks, the Sarco Thermotor costs little more than a steam trap.



Why not let the Sarco Representative near you figure on a simple, inexpensive control hook-up for your plating or degreasing operations?

TR 21 87 48

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with UNICHROME Stop-Off Lacquers and Compounds

Whatever the piece to be plated, simple or complex—whatever the plating and cleaning cycles, moderate or severe—you'll find a Unichrome stop-off that will do the job *right*. Unichrome stop-offs minimize rejects . . . save valuable time and effort.

These six stop-off materials, each formulated to provide a different combination of characteristics, enable you to select the lacquer or compound which will give the best over-all results for any problem you encounter. Write today for prices and data.

3 FAST-DRYING STOP-OFF LACQUERS

These tough, synthetic materials are easily applied and, in general, are used for all simple shapes where areas can be conveniently stopped off by brushing. Available in three formulations, No. 322, 323, and 324, to provide different combinations of characteristics, they all withstand hot cleaners and acid dips, and will not contaminate plating baths.

3 EXTRA-TOUGH STOP-OFF COMPOUNDS

These quick-hardening, wax-like stop-offs are applied by dipping the part in the melted compound, quickly covering even the most complicated shapes and sharp edges with a tough, durable coating. The three separate compounds, No. 311, 314, and 315, provide resistance to solutions of various temperatures, from 160F for No. 314, to 245F for No. 311.

UNICHROME

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*Trade Mark Reg. U S. Pat Off.

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Not if you depend on G-E copper-oxide rectifier units for plating or anodizing power. You can buy one or more individual units today, reconnect them or combine them with additional units tomorrow, and operate with no sacrifice in efficiency.

G-E plating and anodizing rectifiers are part of a complete line of plating and anodizing *systems* developed by G.E., including manual or completely automatic voltage control. For full information or help in selecting a power-saving plating system, write Section A5-358, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

(Above) Bank of G-E "500" Rectifiers, showing compact multiple-unit arrangement.

GENERAL ELECTRIC

EXTEND YOUR SERVICE

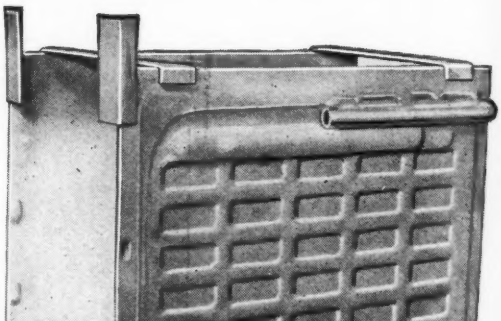
↓

WITH

SILCO

THE MODERN GLASS-BASE SPRAY COAT FOR STEEL AND BRASS

There are thousands of articles that it is not practicable to plate, but you can get this work with SILCO and do a marvelous job! Any plating shop or department can set up for this service at but relatively slight equipment cost and it will greatly increase its present scope.



A refrigerator ice cube compartment, given a rich, long-lasting, eggshell finish with SILCO—just one of a long list of uses.

In color, texture and durability, SILCO stands absolutely alone. As a finish for steel and brass, its results are truly remarkable. Though easily sprayed on with regular equipment, when baked it takes on the hardness of glass.

SILCO withstands heat up to 1000° F., is impervious to dampness and corrosive gases, and has high resistance to abrasion and impact. It comes in any color and in two pleasing eggshell finishes. The application is simple. Spray it on and dry it at 200° F. Then bake in any industrial oven at 350° F. The result will amaze you! Samples on request.

BLACK-MAGIC—A deep-penetrating, 1-bath oxide black that gives all steels except stainless a dense black that won't rub off. Very flexible; forming may follow processing. Also an effective rust inhibitor or bond for paint and lacquer. Chemical reaction at 300° F. There are also BLACK-MAGIC baths for zinc, copper, brass and cadmium. Send for samples and the "Black Book."

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HEAT TREATING SALTS. CLEANERS. ETC.

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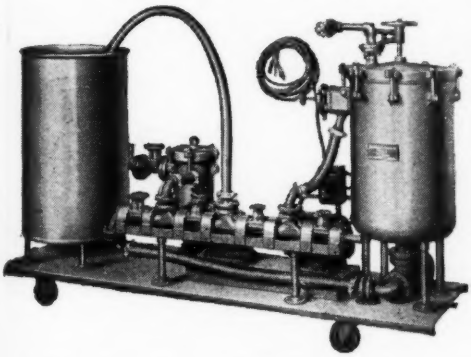
FOR GREATER *Efficiency* AND *Economy*

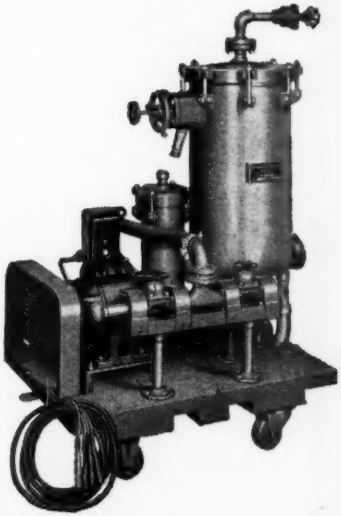
INSTALL MODERN INDUSTRIAL FILTERS IN YOUR PLATING PLANT

You can keep your plating plant operating at top efficiency only if you have adequate filtration. Industrial filter systems are designed and built to provide continuous high speed filtration and circulation.

Industrial Filters equipped with the AIRWASH cleaning feature have been in continuous use for months without opening the filters or removing the plates. Air agitation quickly dislodges the accumulated sludge and leaves the filter clean and ready for a new filter cycle. Many hours of production time are saved thus lowering your operating costs.



No. 1—Filter shown is equipped with slurry tank with double suction and discharge control providing an ideal continuous filtration system.



No. 2—A typical portable filter as constructed for bright nickel, acid copper and other acid type bath. Used for either intermittent or continuous filtration.

Other Products

Salt Fog Corrosion Test Equipment

Centrifugal Pumps of Duriron, Worthite, Stainless Steel, Hard Lead, Bronze and Iron.

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FULL AUTOMATIC MACHINES

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Adaptable to Any Operating Sequence

Simple in design and heavily constructed to operate continuously without excessive maintenance.

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Meaker Process Lines for Electrogalvanizing Wire and Strip Steel

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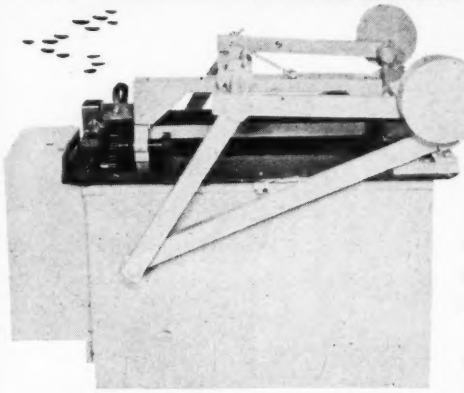
FOR FAST PLATING...

Lasalco's New Intermediate Barrel Plater



Nothing Plates But the Load

- Serves for all jobs requiring capacities between a small utility plater and regular size Richards Barrel Plater.
- Just the *right* size
- For acid or alkaline solutions
- Built for quick loading and unloading
- Maximum flexibility for many jobs
- Requires less operating effort than other barrel platers
- Carefully counterbalanced for easy handling
- Speeds up and increases production
- Can be used for a still plating tank
- Unloading trays are not necessary
- Cylinder and gears made of hard rubber

QUICK AND EASY LOADING

- Note how cylinder is swung forward and head is held in position for loading.
- Switch type negative contact is made automatically when cylinder is lowered into tank.
- Insulated negative connection through hollow hub of cylinder prevents interference while loading or unloading.

SIMPLIFIED TIME-SAVING UNLOADING

- Automatically placed in position for unloading, cylinder is secured by handle and ratchet arrangement. Load can be emptied right into tote baskets — unloading trays are not necessary.

⅛ h.p. motor; 3 speeds—2, 4 or 12 r.p.m.; inside dimension of cylinder—10" dia. x 18"; capacity 8 qts., or 30 lbs., maximum; constructed with steel tank for cyanide solutions, or rubber lined tank for nickel solutions.

LASALCO, INC.

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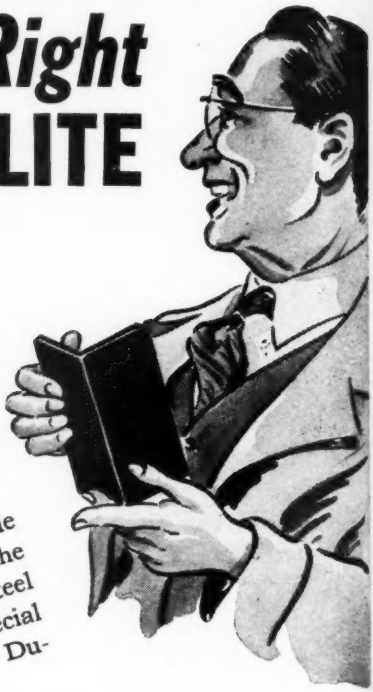
Do It Right with DU-LITE



"Doing it right" with Du-Lite Black Oxide Finish for steel means satisfaction all the way . . . and no more rejects. All steel parts, even those of heat-treated special alloys, are blackened uniformly with Du-Lite . . . and no more headaches.

Why take chances with inferior finishes? Du-Lite has a proved record of performance with all kinds of parts, under all sorts of production conditions. Du-Lite Black Oxide Finish is immediately available.

If it's a uniform, durable, dependable black finish for steel you need, be assured that you can do it right—with DU-LITE.

Phone or Write and the Du-Lite Engineer will call promptly.

DU-LITE CHEMICAL CORP.
MIDDLETOWN, CONNECTICUT

Paul W. C. Strausser

It is with deepest regret that we record the death of Paul W. C. Strausser, January 26, at the age of 54.

At the time of his death he had been a member of the American Electroplaters' Society for well over fifteen years; not only did he serve as the First Vice-President of the Detroit Branch, but took active part in the activities of the Washington Branch during his connection with the National Bureau of Standards. He served the American Electroplaters' Society faithfully, and his loss will be sincerely felt by his many friends.

He was associated with the Chrysler Corporation from 1925 until 1930, devoting his efforts to special research with particular emphasis on development and standardization of plating procedures. A number of the plating methods which we now consider standard are the result of Mr. Strausser's work at that time. From 1930 until 1939 he was the Research Associate of the American Electroplaters' Society at the National Bureau of Standards. During this period he conducted studies on the protective value of electroplated coatings, which involved the preparation of thousands of plated specimens and their exposure to the atmosphere in different parts of the country. The results of these studies were reported in four research papers of the Bureau of Standards, and served as a partial basis for several of the specifications for electrodeposited coatings that have been adopted by the American Electroplaters' Society and the American Society for Testing Materials.

Upon leaving the Bureau of Standards, he joined the F. B. Stevens organization, where he not only engaged in selling activities, but carried on many laboratory investigations covering the products, processes, and equipment marketed by his associates.

Mr. Strausser's work was characterized by untiring industry, patience, care, thoroughness, and reliability. He was an avid reader of technical publications, which resulted in his being very well versed on plating developments throughout the industry.

Aerial Photo — Detroit — 1947 A. E. S. Convention City

EXPOSITION NEWS

During the war, Detroit was known the world over as the "Arsenal of Democracy". Now, that dynamic city, having reconverted to peacetime operations, again becomes the industrial center of the world, and one of its first contributions is the Industrial Finishing Exposition to be held June 23 to 27 inclusive.

This Exposition will be held in historic Convention Hall—known nationally as the home of the Automobile Show. It will provide the first post-war opportunity for A. E. S. members, Engineers and Plant Executives to see the developments of the past few years in metal finishing equipment, processes and supplies, which make up this annual $300,000,000 industry. Many of the exhibits will be in actual operation and a representative group of manufacturers will display a diversified line of finished products.

The Exposition will prove of great educational value to the men who make up this huge industry and create interest in metal finished products by the public who will be cordially invited to attend.

See the January issue for the floor plan of the Exposition.

PUBLICITY COMMITTEE.

A. E. S. CONVENTION

and

INDUSTRIAL FINISHING EXPOSITION

Detroit, Michigan—June 23-27

Detroit, like all large cities, is faced with an acute shortage of hotel facilities for convention purposes; however, you can rest assured your Housing Committee will do everything possible to meet this situation to the satisfaction of all. To achieve this it will be necessary to have the full cooperation of each one who wishes to make Hotel Reservations. Therefore, it is necessary to set forth certain RULES which MUST BE ADHERED TO in order to house ALL who wish to attend this Convention and Exposition.

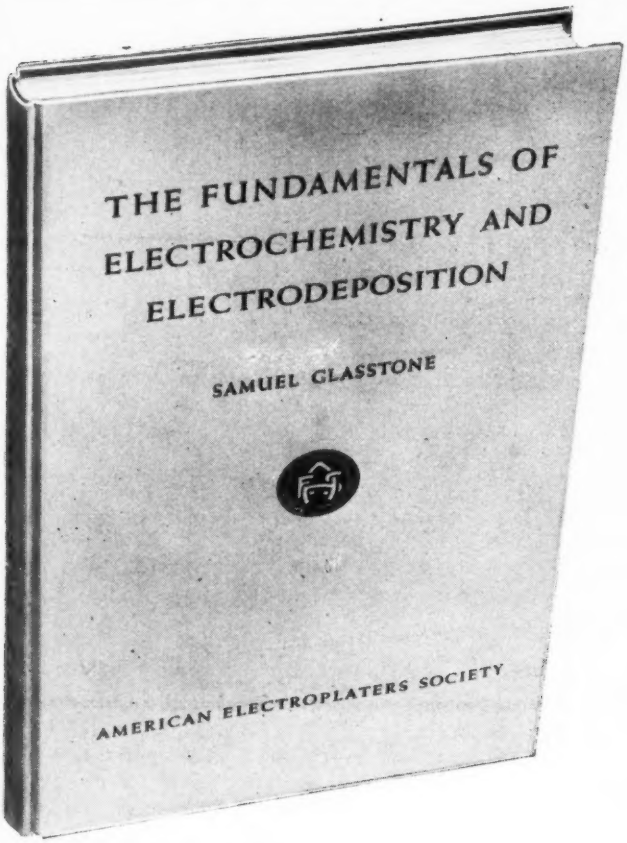
USE STANDARD RESERVATION FORMS

Your Housing Committee is preparing a standard form, which is to be utilized in requesting hotel space. These forms will be provided to all A. E. S. members by the National Headquarters. Exhibitors will receive the forms from the Committee. Please do not request space until you have secured these printed forms. They will be in your hands about March 1, 1947.

IMPORTANT

1. Request for assistance of the Housing Committee in securing Hotel Reservations must be received not later than June 1st, 1947.
2. Please use ONLY the application forms provided, and fill them out completely. The hotels are anxious to take the best possible care of our Convention, and are insisting upon certain information in order to better serve us. Each item on the application is IMPORTANT.
3. There will be very few single rooms available, and we ask your cooperation in "doubling up" with some other delegate. In order to take care of everyone, it will be necessary to assign two to a room in most cases.
4. Please state your choice of hotels. The Committee will do its best to place you in the hotel of your choice, but should that be filled, we will have to ask your cooperation in assignment to some other good hotel.
5. Please make your reservation application as early as possible; remember, assignment will have to be on a basis of "first come, first served."
6. Your Housing Committee is limiting the reservations to the securing of "sleeping rooms" ONLY. Any individual or firm wishing parlor suites or other space for entertainment purposes, MUST make such request direct to the Hotel.
7. The following hotels have accepted room assignments: Barlum, Detroit Leland, Fort Shelby, Fort Wayne, Imperial, Statler, Tuller, Wardell Sheraton, Wolverine.
8. Room rates, due to present conditions, are not firmly established.

JESS E. BUNCH,
Chairman, Housing Committee.
Industrial Finishing Exposition,
Convention Hall, 4484 Cass Ave.,
Detroit 1, Michigan.



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Back Orders Now Being Filled—
Limited Quantity Still Available—

First Come — First Served

SEND YOUR ORDER, WITH CHECK FOR $2.50, NOW
TO

American Electroplaters' Society
P. O. Box 168 **Jenkintown, Pa.**

PROPOSED NEW CONSTITUTION AND BY-LAWS

BY

THOMAS SLATTERY GEORGE B. HOGABOOM
CARL E. HEUSSNER LESLIE BORCHERT
WALTER L. PINNER (Chairman)
CONSTITUTION REVISION COMMITTEE

CONSTITUTION

PREAMBLE

NAME, OBJECT

This society shall be known as "The Electroplaters' Society" (hereinafter referred to as "The Society") and incorporated under the laws of the State of New Jersey.

The objects of this society shall be the improvement and dissemination of knowledge of the art and science of electrodeposition, the finishing of metals, and allied arts; the development of a cooperative spirit of friendship and mutual assistance among its members.

PART I. THE SOCIETY

ARTICLE I. FUNCTIONS

Section 1. Authority: The Executive Board of the Society shall be the governing body and shall consist of the Past-President, President, First Vice-President, Second Vice-President, Third Vice-President, Treasurer, and the Presidents of the Branches. All references to the Executive Board in this constitution refers to the above body. At any meeting of the Executive Board, four (4) of the elected officers of the Society and two (2) Branch Presidents shall constitute a quorum.

ARTICLE II. MEMBERSHIP

Section 1. Classes: The Membership of the Society shall consist of Members, Student Members, Sustaining Members and Honorary Members.

Section 2. Members: Any person interested in the objects of the Society may be nominated for election as a Member.

Section 3. Student Members: Any person not over 25 years of age and regularly enrolled in full time courses of an accredited university or other institution of learning, and who is interested in the objects of the Society, may be elected as a Student Member.

Section 4. Honorary Members: Honorary Membership shall be conferred by a majority vote of the Society in Annual Meeting upon any person whose knowledge and services have added or will add to the welfare of the Society. Any Branch desirous of having a person elected to Honorary Membership shall submit the name of such person with the necessary information to the Executive Board, a majority of which must approve the application before presentation to the Society for election.

Section 5. Sustaining Members: Any firm or person directly interested in the electroplating and metal finishing industry or in the aims and welfare of this Society may upon the contribution of not less than $100.00 per year become a Sustaining Member. The acceptance of such contribution by a majority vote of the Executive Board shall constitute membership. Sustaining Membership shall terminate when contributions have ceased for one fiscal year. All funds received from Sustaining Members shall be used only for investigation of problems and processes directly related to research in the art and science of electroplating or metal finishing or any of its

allied arts. The names of Sustaining Members shall be published each year in the *Proceedings.* Sustaining Members shall receive copies of THE MONTHLY REVIEW, Annual *Proceedings* and all literature pertaining to the art of electroplating or allied arts, issued by the Society.

Section 6. Student Members and Sustaining Members shall have all privileges of membership except that of voting and holding office.

Section 7. Application for membership shall be made to the Executive Secretary on the proper form duly completed by the candidate. All such applications shall be considered by the Executive Board. The application form will require three references by the candidate. Unless a check with these references or any others selected by the Executive Board reveal an objection to the candidate within thirty days, and unless that objection shall have been subsequently upheld by a majority of the Board, the candidate shall, subject to compliance with ARTICLE V, CONSTITUTION, be considered as having been duly elected.

Section 8. Familiarity with Constitution: Each applicant for membership shall receive a copy of the Constitution and By-Laws, which he shall be expected to read and accept, and shall not be allowed to plead ignorance for any violation.

Section 9. Rejection: Any applicant for membership who has failed to qualify according to the Constitution and has been rejected cannot apply again for membership until after a period of one year.

Section 10. Transfer: Any member in good standing transferring from a locality served by one Branch to a locality of another Branch can upon request become a member of the Branch in the locality to which he transfers.

Section 11. Resignation: No member can resign unless he is in good financial standing.

Section 12. Expulsion: On proof that a member has made false or misleading statements in his application for membership, or has acted contrary to this Constitution, he shall be expelled from the Society and all moneys received from him shall be forfeited.

Section 13. Reinstatement: Any member suspended or expelled from the Society may be reinstated by a majority vote of the Executive Board.

Section 14. Application Fee: The minimum application fee shall be Five Dollars ($5.00) to be submitted with the application.

ARTICLE III. DUTIES OF MEMBERS

Section 1. Voting: All Members, except Student Members and Sustaining Members, may vote at the Annual Meeting except when excused by the President.

ARTICLE IV. OFFICERS

Section 1. The Officers of the Society shall consist of a Past-President, President, First Vice-President, Second Vice-President, Third Vice-President, Treasurer, Executive Secretary, Residing Legal Officer and an Executive Board. A member residing in New Jersey shall be appointed to serve as the Residing Legal Officer of the Society in the State of New Jersey. All officers of the Society except the Executive Secretary and the Residing Legal Officer, shall be elected. The Executive Board shall consist of the elected officers of the Society and the Presidents of the Branches. The Executive Secretary and Residing Legal Officer shall be appointed by the Executive Board, and shall continue to serve until his successor is appointed and qualified to serve.

Section 2. Qualifications: Each elected or appointed officer of the Society must be a member of the Society in good standing.

Section 3. Term: The term of each elected officer shall be for one year, or until his successor shall have been elected or appointed. No person may hold the same office more than two years in succession.

Section 4. Vacancies: In the event of a vacancy in the office of President, the Vice-Presidents shall succeed in the order of their rank. In the event of a vacancy in the office of the Treasurer, a Treasurer shall be appointed by the Executive Board to complete the unexpired term.

Section 5. Past-President: The retiring President shall become the official Past-President, and a member of the Executiev Board, but shall continue in office as Presi-

dent until a new President is elected and installed.

Article V. Finances

Dues

Section 1. The annual dues shall be $10.00 for Members and shall be allocated as follows: 50% to the General Fund, 40% to the Branch, and 10% to the Research Fund.

Section 2. The annual dues shall be $5.00 for Student Members and shall be allocated as in Section 1.

Section 3. Members who are not affiliated with a Branch shall have 90% of their dues allocated to the General Fund and 10% to the Research Fund.

Section 4. All funds received from Sustaining Members must be placed in the Research Fund.

Section 5. The $5.00 application fee shall be paid to the Branch with which an elected member becomes affiliated. In the event that a member does not affiliate himself with a Branch, the application fee shall go to the Society.

Article VI. Meetings and Conventions

Section 1. The Annual Meeting: The regular meeting of the Society shall take place during the Annual Convention for the purpose of transacting any business that may be brought before it.

Section 2. Time: The Annual Meeting and Convention shall be held between June 1 and September 30. In the event of national emergency, the Executive Board may waive the Annual Meeting and conduct the affairs of the Society by letter ballot

Section 3. Place: The Convention shall be held at a place decided upon at a previous Convention. Invitations from Branches desiring to entertain the Convention shall be announced at the last business session of the Convention. When more than one Branch presents invitations, the selection shall be made by ballot. In the event that no invitation is received, the Executive Board shall select a convention place with the consent and cooperation of a local Branch. If for a valid reason the convention city must be changed, the location of the Convention will then be left to the Executive Board, with the consent of the Branch in the newly chosen location.

Section 4. Special Meetings: A Special Meeting may be called at the discretion of the Executive Board. It also may be prayed for by at least 100 members in good standing, not more than 20% of which shall be members of any one Branch. The purpose of any Special Meeting shall be stated in writing and the Executive Secretary shall send a copy of the request and purpose of the meeting to each member of the Executive Board. No Special Meeting shall be called to consider any matters that can be decided by law or by the Executive Board in accordance with this Constitution and By-Laws.

Section 5. Fiscal Year: The fiscal year of the Society shall commence on the First day of May. All the financial reports shall be made from and all transactions shall be closed to conform with the ending of the fiscal year of the Society, namely, the Thirtieth (30th) day of April.

Section 6. Privilege of the Floor: Any person who is not a member of the Society may be granted the floor of a Convention by the President or Presiding Officer, but shall have no vote.

Article VII. Charters

Section 1. Granting and Voiding: The Executive Board is authorized to grant charters to groups that have organized in accordance with this Constitution and By-Laws. The Executive Board shall have the right to declare a charter forfeited.

Section 2. Classes: The Society shall grant two classes of Charters: Temporary and Permanent.

Section 3. Temporary Charters: A Temporary Charter may be granted to any group of persons who can comply with the following requirements:

(a) That there shall be not less than ten persons who can qualify as Members under the laws of this Constitution.

(b) That said group pray for a Charter in writing, and that each member over his

signature pledge his loyal support to the Electroplaters' Society and promises to abide by its Constitution and By-Laws.

Section 4. Duration of Temporary Charter: With the approval of the Executive Board, the President may issue a Temporary Charter or revoke the same at any time. This Charter shall be valid until the "Charter Membership" of any organized Branch is closed. It shall be declared void if application for a Permanent Charter is not prayed for within one year after the granting thereof.

Section 5. Permanent Charters: The Executive Board shall grant a Permanent Charter upon the written application of a Branch that has been working under a Temporary Charter for at least three (3) months. No Charter shall be granted to more than one Branch in any one city.

Article VIII. Official Publications

Section 1. The Monthly Review: This Society shall publish The Monthly Review which shall contain articles pertaining to the object of the Society, changes in its membership, news of the organization and its members and of the industry in general, and any other information that may be of value to the readers. Each member of the Society in good standing shall receive a copy of The Monthly Review at one-half the regular subscription price which shall be a part of his annual dues.

Section 2. Proceedings: Each Member in good standing shall receive a copy of the *Proceedings* of the Convention. One copy of the Annual Business Meeting Report shall be sent to each Branch Secretary.

Section 3. Release of Papers: The papers presented before the Society and their discussions shall be the property of the Society and may be released to other journals in accordance with the By-Laws. Those read before the Branches shall remain the property of the author to dispose of as he wishes except that he shall allow printing and distribution to the membership of the local Branch before which the paper was read. In no case shall such paper be published in The Monthly Review without the author's consent.

PART II. BRANCHES

Section 1. Names: Each Branch shall be known as the Branch of the Electroplaters' Society of the city or cities in which the Branch is located.

Section 2. Branches shall elect their officers and committees, and may make any rules for their government not inconsistent with the Constitution and the By-Laws of the Society.

Section 3. Any Branch may receive donations or bequests and may expend or invest the same in the interest of said Branch at the discretion of its members or governing body.

Section 4. Local Branches may assess dues, and raise or collect funds to be expended for local purposes, and may have the entire management and control of expenditures of said funds.

Section 5. Branches shall be chartered on the basis of whole counties and include no counties at least some part of which does not lie within a radius of 75 miles from headquarters. Both headquarters and territory are subject to approval of the Executive Board and any change in territory of the Branches already chartered shall be made only by the Executive Board. In the event that a Charter is prayed for by two or more groups residing within a radius of 75 miles, such Branches may be authorized by the Executive Board.

Section 6. Stationery and Literature: All Branch Societies shall use special forms of application blanks, membership cards and certificates, copies of the Constitution, and such other literature as may be designated by the Executive Board, which must be purchased from the Society.

PART III. REVISION OF CONSTITUTION

Article 1. Revision

Section 1. Authority: No part of the Constitution shall be repealed, altered, annulled, suspended or amended except by a two-third referendum vote of all the members voting. This vote may be at an Annual Meeting or by letter ballot.

Section 2. Amendments: All amendments

shall be submitted to the Executive Board and shall be published in two successive issues of THE MONTHLY REVIEW prior to action.

Section 3. Procedure for Referendum Vote: No referendum vote shall be made unless prayed for by at least 100 members in good standing, no more than 25% of whom shall be members of any one Branch.

ARTICLE II. PARLIAMENTARY AUTHORITY

Section 1. Basis: Roberts' Rules of Order shall be the parliamentary authority for all matters of procedure not especially covered by the Constitution and By-Laws of this Society or by special rules of procedure adopted by the Society.

PART IV. EFFECTIVE DATE OF CONSTITUTION

Section 1. This Constitution shall become effective during the year of its adoption. The officers of that year shall be elected by the delegates according to the present Constitution.

BY-LAWS

PART I. THE SOCIETY

ARTICLE I. ELECTION OF OFFICERS

Section 1. Prior to January 15, the Executive Board shall appoint a Nominating Committee of five members, no two of whom shall be members of a single Branch, and not more than two of whom may be Officers of the Society, who shall send to the Executive Secretary prior to February 15 their nominations of two or more candidates for each office to be filled in the Society, after having notified each candidate of his selection and having received his acceptance.

Section 2. The Executive Secretary shall mail to every Member in good standing on or before March 1, a ballot containing the names of all candidates thus nominated. The voting need not be restricted to the nominees on the ballot. Voting shall be by secret letter ballot; the voter shall sign his name on an outside envelope, and the ballots shall be enclosed in an inner sealed and unmarked envelope.

Voting ballots must reach the Executive Secretary before the first day of May.

Section 3. Prior to May 1, the Executive Board shall appoint three tellers and three alternates, none of whom shall be members of the Executive Board or members of the Nominating Committee or Nominees for office.

Section 4. The tellers shall meet as soon after the first day of May as possible. The Executive Secretary shall deliver to the tellers all ballots received, marking the outside envelopes received from members not entitled to vote because of non-payment of dues. The tellers shall open only the envelopes not thus marked, and shall proceed in secret to count the ballots received. All ballots and unopened envelopes shall be returned to the Executive Secretary who shall preserve them until the Annual Meeting. The Executive Secretary shall return to the senders all rejected envelopes and shall open all unidentified envelopes. The tellers shall prepare and sign a report of the results of the vote, which shall be sealed and shall remain in the possession of one of the tellers selected by them for that purpose, who shall hand this report to the presiding officer at the ensuing Annual Meeting. The presiding officer shall then cause this report to be read, and shall declare duly elected the eligible persons receiving the greatest number of votes for the respective offices.

Section 5. Installation of officers shall take place at the Annual Convention.

ARTICLE II. DUTIES OF OFFICERS

Section 1. Reports: Each officer of this Society shall make a report of his activities to the Annual Convention.

Section 2. President: It shall be the duty of the President to preside at all meetings of the Society, to preserve order, to put all motions before the meeting if duly seconded, to decide all questions of order subject to an appeal to the meeting, to give the deciding vote in case of a tie. He shall be Chairman of the Executive Board. In honor of his office he shall be a member of all committees. He shall call all special meetings of the Society and all meetings of

the Executive Board that may be necessary, at such places as shall be most convenient to the members, and shall state in writing the object of each meeting. He shall appoint all committees not otherwise provided for; in the absence of an officer, appoint a member to act during his absence, and when an officer resigns or dies, appoint with the approval of the Executive Board, a qualified member to fill out the unexpired term.

Section 3. First Vice-President: It shall be the duty of the First Vice-President to perform the duties of the President in the absence, death or resignation of the latter. He shall be a member of the Educational Committee.

Section 4. Second Vice-President: It shall be the duty of the Second Vice-President to perform the duties of the President in the absence of the President and the First Vice-President. He shall be a member of the Membership Committee.

Section 5. Third Vice-President: The Third Vice-President shall perform the duties of the First and Second Vice-Presidents in case of enforced absence or resignation of either of these officers and shall exercise authority in case of absence of the President, First and Second Vice-Presidents. He shall be a member of the Exhibits Committee.

Section 6. Executive Board: The Executive Board shall consider and act upon all matters specifically assigned to it in this Constitution or By-Laws, and such other matters as may be referred to it by the President or the Society. It shall engage the services of an auditor for the examination of the books of the Society.

Section 7. Executive Secretary: It shall be the duty of the Executive Secretary to keep an accurate report of the proceedings of each meeting of the Society and of each meeting of the Executive Board. He shall take charge of all funds of the Society, deposit the funds in such a manner as the Executive Board may direct, and pay all bills properly presented to him for payment with the approval of the Treasurer. He shall receive all money paid in by the members and give receipts therefor. He shall keep an itemized record of all receipts and expenditures, and shall have his accounts audited by a Public Accountant and ready for inspection at each Annual Meeting, or at any time the Executive Board may deem advisable. He shall take charge of and preserve in good condition all papers sent to him by any member of the Society, and attend to the editing and publishing of such matter as the Executive Board may direct. He shall be the Managing Editor of THE MONTHLY REVIEW, the *Proceedings* and of the Convention program. He shall deposit the funds received from advertising in the MONTHLY REVIEW, *Proceedings* and any other publication of the Society in the Publications Fund. He shall have power to appoint members of an Editorial Staff. He shall take charge of all literature belonging to the Society. He shall make such exchange of publications with other journals, institutions or societies as may be approved by the Executive Board. He shall attend to the copyrighting of THE MONTHLY REVIEW, *Proceedings* of each Annual Meeting and all other publications of the Society. He may release papers presented at the Annual Meeting for publication in other journals, with appropriate credit, only after their publication in THE MONTHLY REVIEW and/or the annual *Proceedings*, and release such papers that are not published by the Society at such time as he considers advisable, with the approval of the Executive Board. He shall distribute THE MONTHLY REVIEW to all members of the Society. His salary shall be fixed by the Executive Board and included in the Annual Budget submitted by it. All salaries and expenses shall be paid from the General Fund unless otherwise approved by the Executive Board. He shall furnish the bonds required by the Executive Board. He shall be an ex-officio member of the General Committee for each Annual Convention and shall have the accounts of Conventions audited. He shall be the secretary of the Research Committee and an ex-officio member of the Finance Committee.

Section 8. Treasurer: The Treasurer shall sign all vouchers for expenditures of money by the Society. He shall report to the Annual Meeting on the condition of the

finances of the Society and make such recommendations as will in his opinion tend to safeguard or improve same.

Article III. Committees

Section 1. Appointment: As soon as feasible after his election, the President shall appoint all necessary committees not otherwise provided for. One of the Vice-Presidents shall be appointed a member of each one of the standing committees. Those relating to the Annual Convention shall be announced at the first business meeting of the Convention. Unless otherwise stated, all members of these committees must be members of the Society.

Article IV. Duties of Committees

Section 1. Law Committee: The Law Committee shall be composed of the Past-Presidents of the Society. The most recent Past-President shall serve as Chairman. The Committee may appoint one of its members secretary for the next ensuing year. This committee shall receive a copy of all amendments and revisions of the Constitution and By-Laws and see that they are properly worded and classified.

Section 2. (a) *Convention Program Committee:* The Program Committee for each Convention shall consist of members of the Branch holding the Convention and the Executive Secretary of the Society. At least two months before the Convention, they shall submit to the Executive Board for its approval a report on the plans for the Convention, including any proposed exhibits.

(b) *Registration Fee:* The registration fee of the Convention shall be determined by the Branch sponsoring the Convention, subject to the approval of the Executive Board.

(c) *Profits of the Convention:* All moneys collected in connection with a convention by any means whatsoever are to be applied against actual expenses of said convention. Any profit accruing after all expenses have been paid is to be divided 50% to the Branch holding the convention and 50% to the General Fund of the Society.

Section 3. The Budget Committee: The Budget Committee shall consist of the Executive Board. It shall submit to the Annual Meeting of the Society a budget of the estimated receipts and expenditures for the ensuing year. After this or an amended budget has been approved for the Society, no expenditures for any items shall be increased by more than twenty (20) per cent without the approval by letter ballot of the Executive Board. If at any time the receipts are less than those estimated, the Executive Board shall endeavor to decrease the expenditures accordingly.

Section 4. Research Committee: (a) The Research Committee shall consist of nine persons who are members of the Society, the Executive Secretary, and one representative from any other technical society that may be approved by the Executive Board. Of the original appointees from the Society, three will serve for a three-year period, three for two years and three for one year. Three new members will thereafter be appointed each year for a term of three years, but no member shall be appointed to the Committee for more than two consecutive terms. The Committee shall elect one of its members Chairman who shall serve for a term of one year. No person shall serve as Chairman of the Committee for more than two consecutive terms. This Committee is authorized to solicit funds for research from Branches, persons, firms and organizations. (b) Such funds shall be held in custody by the Executive Secretary of the Society and disbursed with the approval of the Chairman and the Treasurer, and the duly appointed subcommittee of disbursements. (c) The Research Committee shall submit to the Executive Board its general plans for any proposed research, including such cooperation with other societies or institutions as is deemed expedient. When such a project is approved by the Executive Board, the Research Committee is authorized to make the necessary detailed arrangements, including the employment of personnel, and publications and distribution of the results; directly, through sub-committees, or through proper representation on joint committees. (d) The Chairman shall call a meeting of

the committee during the Annual Convention and at least one other time in each fiscal year. A summary report shall be made to the Society at each Annual Convention.

Section 5. Membership Committee: The Executive Board shall appoint as the Membership Committee a group consisting of a member selected by each Branch. A member of the Society not affiliated with a Branch may also be a member of this Committee. A Vice-President of the Society shall be a member of this Committee. This Committee shall take such steps as it deems advisable to retain and increase the membership of the Society.

Section 6. Educational Committee: The Executive Board shall appoint the Educational Committee, which shall include the Librarian or any other member of each Branch. A Vice-President of the Society shall be a member of this Committee. This Committee shall assist Branches in improving their educational sessions by securing speakers, programs, classes and teachers for such meetings.

Section 7. Exhibits Committee: The Executive Board shall appoint the members of the Exhibits Committee, who shall be members of one or more Branches including that in the city in which the Convention is to be held. A Vice-President of the Society shall be a member of this Committee. This Committee shall arrange for and have charge of exhibits of electroplating, the finishing of metals and workmanship by members that shall be held in connection with any Annual Convention, and shall make awards of such prizes as may have been offered and approved by the Executive Board. Exhibitions of manufacturers' products are to be held at the discretion and under the direction of the Executive Board.

Section 8. Committee on Papers' Awards: The President shall appoint before each Convention the Chairman and members of the Committee on Papers' Awards. This Committee shall be governed by permanent rules on Paper Awards which are to be a part of these By-Laws. Any changes or departures from these rules shall be effected by application of the Committee Chairman for approval by the Executive Board at least one year in advance to their becoming effective. Any change in the rules to be made shall automatically become a part of the permanent rules. The Committee shall make selections for such awards and announce its decisions during the Annual Convention or as soon thereafter as practicable.

Section 9. Finance Committee: The Executive Board shall appoint the members of the Finance Committee whose duties shall be to obtain Sustaining Members. At least one member of this Committee shall be a member of the Research Committee.

Article V. Funds

Section 1. General Funds: All income of the Society other than that hereinafter specified shall be kept in the General Fund.

Section 2. Publications Fund: All income from publications including advertising income and income from sale of all publications shall be kept in the Publications Fund.

Section 3. Research Fund: All income received from Sustaining Memberships and other funds especially designated in the By-Laws therefor shall be kept in the Research Fund.

Section 4. Special Funds: All funds collected for special purposes shall be kept by the Executive Secretary in separate accounts and shall not be used except for the specified purpose, except by vote of the Executive Board.

Section 5. The Executive Board has the right to divert in emergencies any Funds, except the Research Fund, for the support of the Society.

PART II. REVISION OF BY-LAWS

Article I. Revision

Section 1. Authority: No part of the By-Laws shall be repealed, altered, annulled, suspended or amended except by a two-third referendum vote of all the members voting. This vote may be at an Annual Meeting or by letter ballot.

Section 2. Amendments: All amendments shall be submitted to the Executive Board and shall be published in two successive

publications of THE MONTHLY REVIEW prior to action.

Section 3 Procedure for Referendum Vote: No referendum vote shall be made unless prayed for by at least 100 members in good standing, no more than 25% of whom shall be members of any one Branch.

PAPER AWARDS

I. The Committee on Paper Awards shall consist of not less than three nor more than five members and shall be separate and distinct from the Committee on Exhibit Awards. No two members of the committee shall be members of any one Branch. The Chairman of the Committee shall be appointed by the President of the Society within sixty days from the adjournment of the Annual Convention. The other members of the Committee are to be appointed by the President from a panel submitted by the Chairman. This panel shall contain the names of not less than twice the number of members to be appointed.

II. *The following paper awards are to be made:*

A. THE HERMINIE DOROTHEA PROCTOR AWARD of $100.00 is to be made to any person for the best paper presented during a contest year at the Annual Convention. This award is given by Charles H. Proctor, Founder of the Society, in memory of the late Mrs. Herminie Dorothea Proctor.

B. THE FOUNDER'S GOLD MEDAL is to be given as the prize for the best paper presented during a contest year at the Annual Convention by a member of the Society. However, if the winner of award A is a member, award B will go to the member who is next in line for award A.

C. An award of $50.00 is to be given for the best paper printed in THE MONTHLY REVIEW during a contest year. The author may be any person, not necessarily a member of the Society.

D. THE ELECTROPLATERS' SOCIETY GOLD MEDAL is to be given to a member for the best paper printed during a contest year in THE MONTHLY REVIEW. However, if the winner of award C is a member, award D will go to the member who is next in line for award C.

E. THE SAMUEL HEUNERFAUTH CUP is to be given for the best paper presented by a Branch and published during the contest year in THE MONTHLY REVIEW or presented during the contest year at the Annual Convention. To be considered a Branch paper, at least five members of the Branch shall have participated in the preparation of the paper, and the librarians of the several Branches shall advise the Chairman of the Paper Awards Committee of those papers which are to be considered as Branch papers and, therefore, eligible for this award.

III. *General Considerations for Award*

A. The "contest year" shall be from the close of one Annual Convention to the close of the Convention in the year for which the award is made. Papers presented at a Branch in one contest year, but printed in THE MONTHLY REVIEW of the following year, shall be classified in the year in which they are printed in THE MONTHLY REVIEW.

B. It is preferable, but not mandatory, that papers to be considered shall be:

(1) Preprinted 30 days in advance of the Annual Convention, or
(2) Submitted to the Committee in triplicate 30 days in advance of the Annual Convention.

C. In judging a paper for an award, there shall be complete disregard of the author's affiliation, e. g., whether he be a Research Associate, or an employee of a company which may benefit from the publication, etc.

D. Papers which have received prior presentation, before other Societies or prior publication outside the publications of the E. S., shall be considered ineligible for competition. This shall include a re-write of such papers, unless the re-write shall contain new material in which case the new material shall be eligible for consideration.

IV. *Specific Considerations for Award*

A. Immediate value to the electroplating or metal finishing industry . . . 30. This shall be measured by such considerations as:

(1) Its money-saving worth in pointing out economies in existing processes
(2) Improvement on existing processes
(3) Simplification of control of process

or of measurement of quality of product

(4) Novel theoretical considerations leading to a more complete understanding of processes

(5) New processes for an existing product

(6) New products.

B. Scientific value.....20
This classification is intended to reward papers having a long-time future value, although they might be of small immediate practical value. A paper may receive a high rating under both A and B.

C. Originality of subject matter, or value as a review paper.....20
A paper which is purely a review paper shall be rated as such on the basis of whether the review was of sufficient scope and was so presented as to be of considerable value to a large number of members.

D. Clarity of presentation.....30
The principal emphasis should be on presentation of subject matter in a clear, understandable manner. Extensive plots, photomicrographs, etc., do not necessarily add to clarity of presentation. The length of the manuscript shall be considered immaterial.

V. *Announcement of paper awards shall be made during the last business session of the Annual Convention, and winners of awards shall be requested in advance to be present.*

EXHIBIT AWARDS

I. The Committee on Exhibit Awards shall consist of five members and shall be separate and distinct from the Committee on Paper Awards. The member of the Branch who is in charge of receiving exhibits shall be a member of this Committee. The Vice-Chairman shall submit a panel of six names to the President of the Society, who shall appoint the other three members of this Committee; except that the Vice-President and members of the Branch in charge of receiving exhibits may be members of the same Branch, no two members of the Committee shall be members of any one Branch.

II. *The following exhibit awards are to be made:*

A. The Metal Finishing Cup shall be the first or highest award for a Branch exhibit.

B. First, second and third paper awards are to be given for the individual exhibits.

III. *Secret or patented processes*

The question of considering exhibits finished by use of secret or patented solutions or processes shall be left primarily to the discretion of the Committee. As a suggestion, the use of any generally known bright nickel bath covered by patents or on which patents are pending, or of a bright copper bath in a similar situation, shall not preclude consideration. On the other hand, a situation wherein the technique employed is *completely obscure* should deprive an exhibit of consideration. Fundamentally, the exhibits are for the purpose of giving practical information about the art of plating and as a measure of the individual skill of those submitting exhibits.

IV. *In considering exhibits, they shall be rated as follows:*

A. The general make-up of the exhibit considering appearance, attractiveness, and artistic motive.....10

B. The overall practical value of the finishes employed on the individual items making up the exhibit.....20

C. Special skill or originality required in the preparation of any or all items in any one exhibit.....20

D. Quality of finish as indicated by freedom from defects, such as pits, poor polishing, poor coverage in the case of plated and buffed articles.....10

E. Disclosure of new or improved processes or sequence of operations which make for decreased cost or improvement in product, and as such are of value to industry.....30

F. Efforts used in preparation, scope of processes covered, and number of members contributing. Proportion of branch membership contributing shall be considered in case of a stalemate.....10

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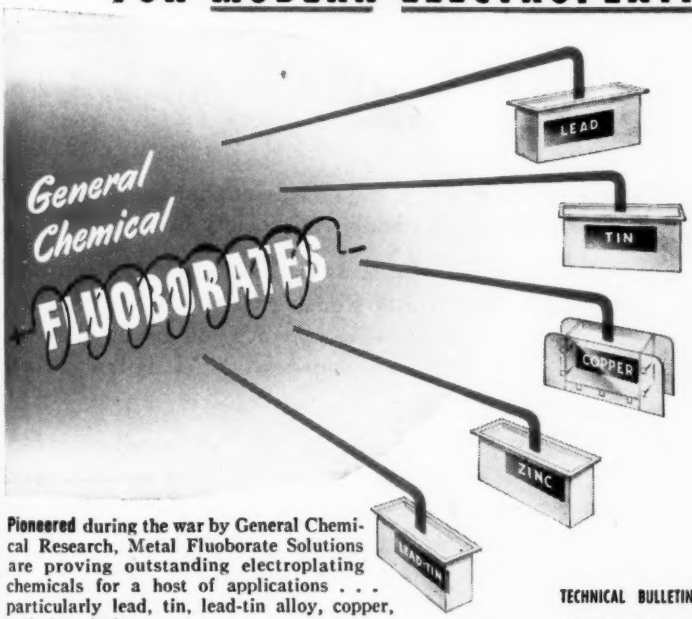

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Our Society

Have you noticed the new spirit, the new drive that has characterized the activities of the American Electroplaters' Society lately?

In reporting to the membership at the Pittsburgh Convention on his term as A. E. S. President, Walter Pinner presented concrete facts in proof that this Society is truly progressive. Won't you get out your copy of the *Reports of the National Officers* and re-read it? It is truly worth a thorough study.

The facts presented by Mr. Pinner can provide excellent material in promoting an intensive membership campaign. As an instance, he reports that we are now a recognized technical society. Our various research projects emphasize this. Electroplating has progressed from an art to a science. In so doing, it has drawn from all the sciences, chemistry, metallurgy, chemical engineering, and mechanical engineering to mention a few. The people engaged in these sciences are becoming interested in us and our accomplishments. Let's tell them about our Society and its aim to further the science of electroplating.

Most of our Branches are located in large cities, in many of which are situated Universities or research institutions, or both. One such city is Pittsburgh and here are found the University of Pittsburgh, Carnegie Institute of Technology, Mellon Institute and the Westinghouse Research Laboratories. The Pittsburgh Branch is canvassing these institutions for new members.

Other Branches can survey their cities for similar institutions. From these sources, the Branch will get learned and interested members who, in many cases, will participate in the educational program. The new members in turn will receive the many benefits which accrue from membership in the American Electroplaters' Society.

S. S. JOHNSTON,

Membership Chairman

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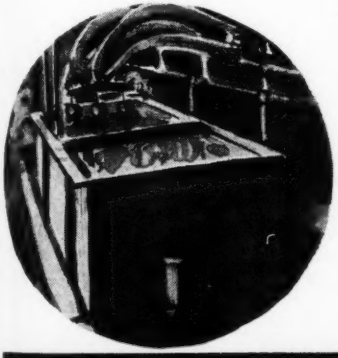
it has lately been necessary to raise them somewhat to cover the greatly increased cost of raw materials. Prior to this we had absorbed all increased labor and incoming freight costs . . . And these new prices make no allowance for any increased costs from the standpoint of labor, operating or sales overhead.



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PLATED ZINC BASE DIE CASTINGS

A Symposium

The frequency of corrosion failure of copper-nickel-chromium plated zinc base alloy die castings makes necessary a re-evaluation of present practices in their manufacture and plating.

The three papers which follow were presented at the Annual Educational Session of the Detroit Branch on December 14.

Another series was given at the Annual Educational Session of the Chicago Branch on January 25. It will be published at a later date.

MANUFACTURE OF ZINC BASE ALLOY DIE CASTINGS

J. C. Fox

DOEHLER - JARVIS CORPORATION — NEW YORK CITY

Introduction

Progress in the Die Casting Industry continues year by year. Not only is the consumption of zinc, aluminum, magnesium, and brass die castings expanding rapidly, but the size and complexity of castings are increasing. Any present limitation on die casting size is primarily set by the size of available casting machines. Thus, the building of larger and stronger casting machines is being forced to handle larger parts. Problems relating to die design and construction, as well as steel metallurgy and casting technique, multiply as the size of die castings increase.

Of all the alloys being currently die cast, the electroplater is most interested in the zinc base alloy. This is chiefly due to their extensive use, especially in automotive construction.

The high rate of production of accurately finished castings at relatively low cost, the close dimensional limits, the smoothness of the cast surfaces that promotes ease of finishing, the ease of machinability and the wide variety of shapes and sizes made possible by the die casting process, are some of the reasons for the wide application of zinc base die castings.

In the pre-war year of 1941, zinc die castings represented about 65% of the total die casting production. About 150,000 tons of the 99.99+% zinc were used in the production of die castings that year.

The automotive industry was the largest single user of zinc die castings for grilles, louvres, trim hardware, carburetors, fuel pumps and numerous other similar parts.

In 1946 the consumption of 99.99+% zinc for die castings is expected to equal or pass the 150,000-ton mark, and it is estimated that between 57,000 and 60,000 tons of zinc die castings will be used for automotive passenger cars and another 10,000 tons for truck parts. Thus, the automotive industry still takes a large share of the total zinc die castings produced.

Other industries such as the electrical,

household, utilities, business machines, tools, and many others consume large quantities.

Evolution of the Alloy

The first zinc alloy die castings were produced about 1907 following the commercial development of the die casting of tin and lead base alloys which utilized the principle of the Mergenthaler Linotype machine, i. e., the use of a cylinder and plunger submerged in the molten alloy.

Because of the serious limitations on tin and lead alloys as to strength and low fusion points, the early experimenters set out to cast higher melting point alloys. Zinc, being next higher in melting point, was then tried.

The first zinc base die casting alloys were made of any kind of elementary zinc available with small amounts of copper and tin, the latter ranging from 4 to 8%. A little aluminum, about 0.5%, was a necessary addition to prevent the formation of the zinc-iron sludge at the bottom of the casting pot.

These alloys were weak, hot-short and subject to rapid disintegration and deterioration. They fell in and out of use regularly because of failures in service. After the development of the die casting of aluminum base alloys about 1915, they were practically discarded for a time.

However, because of the great economies associated with the die casting of the lower melting point alloys, a strong effort was made to develop better and more suitable zinc base alloys.

During the years 1915–1920, there were many fanciful compositions offered and exploited with exaggerated claims for their virtues. Ternary alloys containing about 3% copper, 12% aluminum, remainder zinc, showed fair physical properties as cast, and test bars of this alloy could be bent 90° to 120° without fracture. But before a bending demonstration could be made, it was necessary to make certain that the test bars were relatively "fresh" or not aged too long.

Even with the use of the then available highest grade zinc—of 99.90% purity—the alloys were susceptible to intercrystalline corrosion and dimensional changes on aging, especially under hot, humid conditions.

Alloys of the 99.90% zinc with a lower aluminum content of about 5% were used next and gave better all-around results, but their aging characteristics still were not fully satisfactory. Between 1920 and 1930 a concentrated study of the mechanism and cause of failure of zinc base alloys was undertaken. The excellent work of Williams, Brauer and Pierce, Anderson, Wilcox, Fuller, Edmunds, Werley and others contributed greatly to the knowledge obtained.

The determination of how to insure permanence of size, shape and properties in zinc base alloys is one of the outstanding metallurgical developments of recent years. It was accomplished by adequate control of the quantities of certain elements that effect the transition of the metastable phase in zinc-aluminum alloys with resulting dimensional changes and intercrystalline oxidation. It was found that freedom from detrimental changes and loss of physical properties could only be insured by the use of the highest purity zinc of the 99.99+% grade, the first carload of which was received November, 1929. Since that time, Special High Grade has become standard for use in zinc die castings. It is generally recognized that no grade of lower quality can be tolerated.

Table I shows a comparison of the aging properties of old and present type zinc base die casting alloys.

The designation 4–3 was an alloy containing 4% aluminum, 3% copper, and remainder zinc assaying about 99.90% purity. The alloy designated 12–3 contained 12% aluminum, 3% copper, and zinc of 99.90% purity. The designation 6% tin refers to a copper-tin-aluminum alloy which consisted of 3% copper, 6% tin, about 0.5% aluminum, remainder 99.90% purity zinc.

Special High Grade Zinc

Table II shows typical compositions of the 99.99+% grade of zinc made by several producers. One shows an average lead content of 0.004%, the very maximum lead content which can be tolerated because of

TABLE I

Relative Properties of Zinc Die Castings
1922 vs. 1938

Property and Aging Period	Old Alloys (1922)			New Alloys (1938)		
	No. 4–3	No. 12–3	6% Tin	No. 2	No. 3	No. 5
Impact Strength, ft-lb (b)						
As-cast	5.5	1.2	1.0	19	20	18
10-day steam, 95° C	0.25	(a)	0.25	1	22	11
10-day dry heat, 95° C	....	....	....	2	23	16
4-year indoor aging	0.25	0.25	0.25	5	22	20
7-year indoor aging (c)	....	....	....	2	17	18
Dimensional change, inch in 6 inches						
10 day steam, 95° C	0.268	(a)	0.065	0.0128	0.0038	0.0033
10-day dry heat, 95° C	.....	....	.....	0.0144	0.0015	0.0023
4-year indoor aging	0.031	no data	0.004	0.0044	0.0005	0.0009
7-year indoor aging (c)	.....	....	.....	0.0091	0.0011	0.0007
Tensile Strength, psi						
As-cast	41,700	38,500	24,900	47,900	40,300	45,400
10-day steam, 95° C	9,300 (a)	(a)	9,700	45,100	33,200	35,700
10-day dry heat, 95° C	.....	.....	.....	45,500	34,400	37,400
4-year indoor aging	24,800	17,700	20,000	49,200	34,600	38,200
7-year indoor aging (c)	.....	.....	.....	48,700	32,900	37,400
Elongation, % in 2 inches						
As-cast	2.5	no data	no data	5.1	4.7	4.9
10-day steam, 95° C	0	(a)	no data	1.0	5.5	1.8
10-day dry heat, 95° C	...	.....	.....	1.4	9.0	6.6
4-year indoor aging	0	no data	no data	4.1	7.5	6.9
7-year indoor aging (c)	...	.....	.....	3.1	8.1	5.6

NOTES: (a) Specimens disintegrated. (b) Unnotched bar, ¼ x ¼ inch. (c) Data for newer alloys are indicative of their stability; no corresponding figures available for the older alloys.

the special care that it necessitates in the selection of the aluminum used in alloying. With it, the lead content of the aluminum must be kept below 0.02% in order that the lead content of the ultimate casting be appreciably below the 0.007% maximum specified.

It is generally conceded that the development and use of Special High Grade zinc has given zinc die casting its greatest impetus. Out of a total production of about 250,000 tons in 1946, about 150,000 tons will be used for the production of zinc die castings.

TABLE II
Typical Analyses of Special High Grade Zinc

Supplier	Composition, Per cent			
	Lead	Cadmium	Iron	Zinc (By Diff.)
A	0.0008	0.0005	0.0007	99.9980
	0.0009	0.0007	0.0010	99.9972
B	0.0025	0.0010	0.0008	99.9952
	0.0030	0.0025	0.0010	99.9935
C	0.0040	0.0010	0.0010	99.9940
	0.0040	0.0020	0.0007	99.9933

Composition of Zinc Base Alloys

Table III shows the composition of the three commonly used zinc base alloys for die casting. These three alloys have been adopted and specified by the A. S. T. M., S. A. E., and other standardizing bodies after long series of tests have justified their selection.

These alloys are based on the use of 99.99+% zinc. All contain approximately 4% aluminum and differ only by their copper content. The No. 2 alloy with 2.5 to 2.7% copper is gradually becoming obsolete because it shows poorer aging properties than either of the other two alloys, No. 3 and No. 5. There is little to choose between the latter. The No. 3 alloy, although it has somewhat lower tensile strength and hardness than No. 5, possesses somewhat better properties after aging over a long period of time. The No. 5 is said to possess better surface corrosion resistance when used without surface protection.

The limits on each constituent of these alloys have been carefully established after many years of experience and thorough testing. While each constituent has a specified minimum and maximum, there is an optimum content for each which produces best all-around results.

For instance, while the *aluminum* content is specified at from 3.50 to 4.30% in standard specifications, the best working content is considered to be about 4.0%. Appreciably above 4.30% affects impact strength, and with 5.00% the alloy is quite brittle. On the low side, with less than the minimum of 3.50% aluminum, poorer castability and lower properties are the results.

Copper increases tensile strength, hardness and surface corrosion resistance. However, it adversely affects the ductility, impact strength and dimensional stability on aging.

The No. 3 alloy can stand a copper content of up to 0.25% without decrease in properties due to aging. Still higher copper contents causes the alloy to be more susceptible to the effects of tin if the latter is at the specified maximum.

The No. 5 alloy is not seriously affected by copper contents outside the specifications limits. Copper appreciably above the maximum will increase surface corrosion resistance, hardness and strength, but the alloy will show aging effects with subsequent loss of impact strength and more dimensional growth than if the copper is held at the mean amount.

Magnesium is a necessary addition to the zinc alloys and acts primarily as an inhibitor of the sub-surface corrosion which may otherwise occur. The optimum content is 0.04% with 0.03% as the very minimum to maintain permanence of properties and dimensions. Magnesium above 0.05% and especially approaching the 0.08% allowed in the specifications is conducive to "hot-shortness" in casting and to lowering of the impact strength.

Lead should be kept below the specified 0.007% maximum to avoid intercrystalline corrosion. Care should be exercised in the selection and use of aluminum. The aluminum used must not contain more than 0.02% lead, and contamination with lead-containing materials such as solder, foil, cigarette papers and lead paint must, of course, be guarded against.

In the absence of contamination by material containing *cadmium*, there is no difficulty in holding to the 0.005% maximum

TABLE III

Composition Limits for Standard Zinc Base Die Casting Alloys

Constituent or Impurity	Alloy No. 2 A. S. T. M. No. XXI S. A. E. No. 921	Alloy No. 3 A. S. T. M. No. XXII S. A. E. No. 921	Alloy No. 5 A. S. T. M. No. XXV S. A. E. No. 925
Copper, %	2.50–3.50	0.10 max.	0.75–1.25
Aluminum, %	3.50–4.50	3.50–4.30	3.50–4.30
Magnesium, %	0.20–0.10	0.03–0.08	0.03–0.08
Iron, % max.	0.100	0.100	0.100
Lead, % max.	0.007	0.007	0.007
Cadmium, % max.	0.005	0.005	0.005
Tin, % max.	0.005	0.005	0.005
Zinc, %	Remainder	Remainder	Remainder

set forth in these specifications.

About 0.02% *iron* is soluble in the liquid zinc alloy. Iron present above this amount combines with the aluminum and tends to rise to the surface from which it is periodically removed as dross. Iron up to the 0.100% maximum will have no effect on the permanence of properties and dimensions. If any of the high iron-aluminum compounds should inadvertently get into the casting, they will show up as hard spots and affect machinability. This, however, can happen only by carelessness.

In addition to the care necessary in the selection of the proper grades of raw metal for the zinc die casting alloy, extreme precaution must be exercised to insure against accidental contamination by injurious metals and alloys such as lead, tin, cadmium, bismuth and some others.

Zinc die casting must be segregated from the casting of other alloys, particularly from the casting of tin and lead base alloys. The presence of lead and tin materials, such as lead hammers, counterweights, matrix metal, solder, foil, tobacco wrappings and other like articles must be prohibited in or near the area for die casting of zinc alloys. Likewise, cadmium materials such as plated inserts and castings must be prevented from coming into contact with the molten zinc die casting alloy.

Microstructure of Zinc-Aluminum Alloys

In the present type of zinc alloy containing about 4% aluminum, the microstructure consists chiefly of a eutectic of the alpha constituent (containing less than 1% aluminum in solid solution with zinc) in excess and the beta constituent which corresponds to the compound Al_2Zn_3. This beta constituent is unstable below 256° C (460.8° F) and tends to decompose at temperatures below 256° C into the alpha and gamma phases, which latter phase contains up to 20% zinc in solid solution with aluminum.

Microscopic examination reveals that this transformation takes place with a change from the large-grained, homogeneous phase into a fine-grained, intimate mixture of alpha and gamma solid solutions, and is accompanied by some increase in hardness, some evolution of heat and a slight decrease in volume. The addition to zinc-aluminum alloys of other elements such as copper and magnesium tends to prevent this transition from taking place during casting and shortly thereafter, but it does not prevent the phase change from occurring extremely slowly at normal temperatures, the completion of which may take several years.

This phase change is the subject of much study in an effort to prevent it either by additions of other elements or by some treatment.

It is one of the two causes for the slight change in properties and dimensions which take place in the present type of zinc alloy. The other cause is a certain type of corrosion, known as intercrystalline or intergranular, in which the grain boundaries are selectively attacked in the presence of corrosive media.

It has been found that small percentages, particularly of tin, lead or cadmium, accelerate intercrystalline corrosion. This is why the earlier types of zinc alloys, prepared from inferior grades of zinc that carried appreciable amounts of these detrimental impurities, were subject to rapid deterioration and failure.

Table IV presents the latest physical properties of the as-cast No. 3 and No. 5 alloys. They were determined with die cast test bars produced under the best casting conditions from a die which has been designed as a result of the work of G. L. Werley[1] of New Jersey Zinc Company.

Casting Practice

While considerable stress has been laid upon control of the chemical composition of the zinc alloys, the physical side of producing sound quality die castings is of equal importance.

It has become quite evident and generally recognized that the as-cast surface of die castings which are to be electroplated must be sound and free from surface porosity, run-marks and similar defects if a high quality enduring plated coating is to be had. In fact, it is well established that the life of a plated coating depends on the surface finish of the raw casting. Plating

TABLE IV

Mechanical Properties of No. 3 and No. 5 Alloys

Mechanical Properties	Testing Temperature					
	−40° C −40° F	−20° C −4° F	0° C 32° F	21° C 70° F	40° C 104° F	95° C 203° F
No. 3 Alloy						
Tensile Strength, psi.....	44,800	43,700	41,300	41,000	35,500	28,300
Impact Strength, ft-lb on ¼ x ¼ inch bars.....	2	4	23	43	42	40
Brinell Hardness.....	91	87	82	82	68	43
Elongation, % in 2 inches....	3	4	6	10	16	30
No. 5 Alloy						
Tensile Strength, psi.....	48,900	49,400	48,300	47,600	42,900	35,100
Impact Strength, ft-lb on ¼ x ¼ inch bars.....	2	4	41	48	46	43
Brinell Hardness.....	107	104	99	91	89	62
Elongation, % in 2 inches....	2	3	6	7	13	23

failures, such as premature blistering, can often be traced to pits and similar casting surface defects. Therefore, as one prime factor in quality plating, the surface finish of a casting must be such as to require very little preparation prior to plating.

To produce such a finish, it is necessary to regulate and coordinate all casting variables, such as gating, venting, die and metal temperatures, pressures, shot speed and lubrication. This is not easy and requires considerable time and effort at the start of production or in the breaking-in of a new die. As a consequence, the first run of a die cast part, especially if the die caster is rushed as happens all too often, is not as good as required or as in subsequent runs when time has permitted improvements in the production technique.

With simple parts, such as automotive handles, it is relatively easy to produce the desired "plating or hardware finish" on the castings because of previous experience with similar parts. The problem of producing such a finish on large zinc castings is more difficult, and at times it may be necessary to do some polishing with 180 emery on the remote ends and sections. The ideal casting finish is such as to require only light buffing or coloring for the sole purpose of removing the oxide film formed in the casting operation. While this finish is not always achieved, it should be sought diligently.

The condition of the die surface on which die castings are produced is of importance, but less so than proper gating and other conditions. When all other casting factors are in line, a highly polished die will result in better looking castings than if the die is rough and coated with oxides. Since a die casting faithfully reflects the condition of a die surface, it is necessary to keep the latter smooth and clean. Castings emanating from a highly polished die will show the polished lustre, but shortly the die will become somewhat dulled due to the attack on the steel by the molten zinc alloy and formation of a gray film of oxides. Attempts to maintain the polished lustre on dies by such means as chromium plating have not been too successful. A periodic vapor blast treatment with very fine abrasive of 325 mesh or higher, cleans and smooths the die surfaces and leaves them in a very fine matte condition.

Lubricant—The choice of die lubricant is extremely important. It must lubricate properly without affecting the casting finish even when applied after each casting cycle which, of course, is not always necessary.

Gating—Because dies necessarily differ from one another in shape, size and contour,

each die is an entity in itself and must be treated accordingly.

It has ever been the hope that some formula would be developed which could be readily used to indicate the type, shape and area of the gate and its relation to runners and overflows or vents that would yield the best surface condition and maximum soundness of the die casting. Unfortunatelv, no such formula is yet available. The matter of gating is still empirical, and we must continue to rely solely on experience, past performance and cut-and-try methods.

There is now functioning a Die Casting Research Committee, a sub-committee of A. S. T. M. Committee B-6, which has for its purpose the solution of some of the problems relating to the die casting process, especially those pertaining to the physical factors. It is hoped that something of value will come out of the work of this committee.

Die Temperature—The importance of controlling the temperature of the dies during casting is well established since it affects the structure, appearance and properties. The work by Werley[1] on the effect of die temperature on physical properties indicates that the best operating temperature for the casting of No. 3 alloy is 350° to 425° F while for No. 5 a range of 350° to 475° F is most satisfactory.

The insertion in strategic locations in dies of thermocouples connected with a potentiometer recorder during the casting operation, will enable one to learn a great deal about the effect of die temperature. Dies which are operated too cold will give castings of poor surface finish and relatively low impact strength. Too high a temperature can also adversely affect the properties of the die casting.

Metal Temperature—The casting temperature of the alloy does not exert too great an influence on finish or properties unless it greatly exceeds 800° F, which should be considered the maximum casting temperature of the metal. It is found that an alloy temperature of 775° F generally can be adopted for all types of castings.

Die Casting Machines

The first commercially successful die casting machine was patented in 1905 by H. H. Doehler and used for the production of lead, tin and zinc base alloys by the Doehler Die Casting Company during its early history.

In comparison with the present die casting machines for zinc, this first machine was very simple and crude, but it was typical of its time and was used quite successfully in the production of such parts as magnet housings and carburetors in the early days of the automotive industry and until about 1915. It was run entirely by manual power and required three to four men to operate it.

The modern one-man zinc die casting machine does not differ in principle from the first machine. Hydraulic power is now almost universally used to supplant pneumatic power, and manual labor has been greatly reduced by the introduction of timing clocks, limit switches and other devices which make the operation of the modern machine almost automatic. Present operating speed is between 300 and 500 casting cyles per hour and is limited only by the rate at which heat can be removed from the die.

With accurate control of such variables as metal and die temperatures, pressure on the metal and speed of injection, the modern die casting machine is capable of producing sound die castings.

Dies

First and most important step in the manufacture of die castings is the proper design of the die. It devolves upon the die designer to consider many vital factors in the design and construction of the die. He must bear in mind the customer's requirements as well as the casting man's problems.

Essentially, a simple die consists of two blocks of steel, each containing a part of the casting impression. When these blocks are mounted on the casting machine, they are so arranged that one, usually termed the cover die, is stationary, and that the other, termed the ejector block, is movable. The blocks are locked together when a casting is made and then drawn apart to allow it to be ejected.

The movable block usually contains, in addition to part of the casting impression,

all movable elements such as cores, slides, and ejector mechanisms. It is desirable to have the castings remain in the ejector half upon opening the die so that it can be readily removed.

Under uniform casting conditions, the dimensions of the solid parts of the die blocks and of the resulting castings remain practically unchanged. Parts of dies which contain slides, movable cores and loose pieces, however, must have wider tolerances. Across the parting line made by the joining of the two halves of the die, still more liberal tolerances are needed. Thus, wherever possible, one should design the die so that the important dimensions come within the solid or fixed parts and the unimportant ones within the movable parts.

Slides, cores, loose pieces and other movable parts on the die leave seams and fins on the surface of the casting which must be removed. It is the duty of the die designer to eliminate or minimize them wherever possible, not only for the appearance of the casting but also because of the cost of removal. Similarly, the parting line of the die must be carefully established as well as the location of stationary and movable cores.

The location of the gate or metal inlet and its dimensions in relation to the area of the casting are of vital importance.

Since all dies are made of steel, it is evident that separate exits must be provided for the air in the die impression when it is being displaced by molten metal. Failure to provide suitable vents in the die will result in unsound castings. Many methods of venting are available and the die designer must determine which one to use from the size, contour and section of the casting.

Means must also be provided for rapidly ejecting the casting from the die. It is the task of the designer to place ejector pins in such positions that they will eject the hot casting without distorting it and without leaving pin marks where they would be objectionable to the customer.

Quite often designers of metal parts do not know of, appreciate, or take full advantage of the potentialities of the die casting process. Close cooperation between the designer and the die casting engineer is urged as most essential. Early contact, especially during the formative stage of design of a part, will result in mutual advantage. The die casting engineer is in a position to advise on:

How to design to minimize die costs.

How to design to reduce production difficulties.

How to design to reduce plating and other finishing costs.

How to design to reduce assembly costs.

What alloy to use which will best meet the functional requirements of the part.

Strength, accuracy and uniformity are fundamental factors in the quality of die castings, and careful control of them will result in benefits to both producer and consumer. Strength is maintained by proper design and careful selection and control of alloys. Accuracy is obtained by careful calculation of shrinkage and precise die construction. Uniformity depends upon complete coordination of all factors and elimination of variables.

The buyer must carefully select his source of supply of die castings for reliability. The alloys must be subjected to chemical and metallurgical control both in their preparation and in the casting operation and kept within the limits set by standard specifications. Rigid inspection for accuracy and uniformity is of equal importance.

Design Features of Zinc Die Castings

Plain Flat Areas should be avoided wherever possible because of the difficulty in obtaining high surface finish where desired. They should be slightly curved, or broken with some inexpensive design such as slightly raised lines.

Draft Allowance—Draft on cores are necessary in order to permit ejection of the castings from the die. In general, 0.010 to 0.020 inch draft per inch on inside and 0.005 inch on outside dimensions are sufficient in normal practice. In some cases, by special means, drafts may be reduced below these limits or completely avoided for short lengths.

Cored Holes—The smallest diameter cored hole in the die casting of zinc alloys is usually

3/32 inch. Smaller holes may be cast under special conditions, but it is generally more economical to drill or to punch them afterwards.

The minimum diameter of a cored hole varies with its depth, the restrictions on draft allowances, and to some extent with the size and shape of the casting. The minimum diameters shown in Table V represent normal practice, allowing 0.005 inch draft per inch.

TABLE V

Minimum Core Diameter vs. Depth of Hole

Depth of Hole, inch	1/4	1/2	1	2
Minimum Core Diameter, inch.....	3/32	5/32	3/16	9/32

It is inadvisable to cast internal threads; it is invariably cheaper to tap the threads.

Fillets—Sharp inside corners are sources of weakness in any casting and should be avoided through the use of fillets. Even the smallest fillet has an appreciable strengthening effect.

Cast Studs—Where studs are die cast integrally with the casting, a minimum fillet of 1/8 inch radius at the base should be specified. The following rules should be observed:

Allow a minimum of 1/8 inch between the end of the thread and base

Chamfer the tip of the stud for ease of assembly

As a rule, never use studs of less than 1/4 inch diameter

Use speed nuts wherever possible

Tapped bosses are preferable to threaded studs.

Thin-Walled Castings—Allow a bead on all surfaces which require trimming. The bead diminishes chances of warping and provides a good place to gate the casting.

Ribs—Wherever possible, ribs should be added to thin-walled castings to strengthen them. Ribs assist in preventing castings from deforming when hot and serve the same purpose in trimming and other operations.

Blind Holes—Through holes are often specified when only one opening is necessary. The extra opening requires a trimming operation which can be eliminated by coring it as a blind hole.

Undercuts—Undercuts increase die and casting costs. They are feasible and used in some cases, but as a rule they are so costly that every effort should be made to avoid them. The die casting engineer can frequently be of service in suggesting expedients to avoid undercuts at a cost saving.

Metal Savers—Metal savers are justified when they reduce the cost of die casting appreciably without impairing strength or perfection. They are usually not warranted when cores must be moved or when extra trimming operations result through their use.

Die Steels

Steel plays an extremely important role in the manufacture of die castings. Upon it rests the responsibility for the economical operation of the process and for its further development, especially in the die casting of the higher melting point metals and alloys.

Steel for dies must be absolutely uniform, sound, and free from inclusions and segregated impurities. It must be of relatively high machinability; be capable of heat treatment without undue dimensional changes, warpage, cracking, etc.; and possess good resistance to heat checking and resistance to erosion or the solvent action of the molten alloy in contact with its surfaces.

Since the surface of a die casting faithfully reflects the condition of the die surface, any surface defects such as minute holes, cracks and tool marks left in the die surface will readily show on the casting. It is obvious that the die steel must be absolutely clean and free from segregation, sonims, cracks, hammer bursts, seams, scabs and other mechanical defects and impurities.

Electric furnace steel is usually specified in order to minimize occurrence of such defects. In addition, it is well to specify that the die steel be given sufficient crop to insure soundness, that the steel receive a minimum reduction from the ingot to the finished bar or block, and that precau-

tion be exercised to maintain proper working and finishing temperatures in order that the finest possible grain structure be had without the introduction of cold working strains.

Die casting dies are ordinarily fabricated from steel in the fully annealed state, chiefly for *machinability*. The more difficult a steel is to machine, the higher is the ultimate cost of the die since 80 to 90% of the die cost is labor. Ordinary carbon or low alloy steels will machine about 10% easier than the higher alloy steels. As the alloy content increases, the cost of machining increases proportionately.

For the die casting of zinc alloys, dies may be made from 0.40% carbon steel and used in the unhardened state with some success, especially for simple dies in low production. However, a steel of 0.40% carbon and 0.80% chromium would be better, and in the annealed state would yield about 100,000 casting cycles before replacement. If the latter steel is heat treated to a Brinell hardness of 350 to 400, it will give far longer die life.

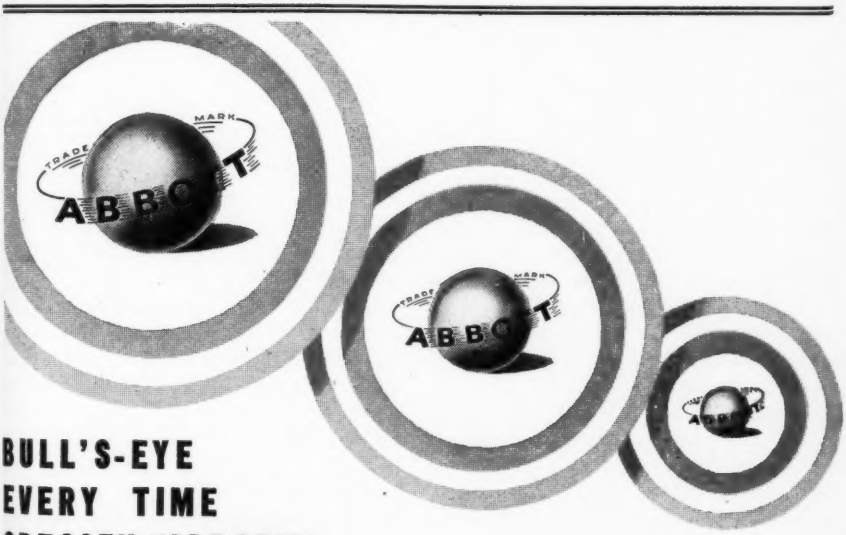
A higher alloy steel (0.40% carbon, 5% chromium, 1% molybdenum), similar to that which is used for aluminum and magnesium die casting dies, when properly heat treated to about 400 Brinell, has been found best suited for long run production of zinc parts such as are encountered in automotive manufacturing. The hardening of dies for zinc alloys increases resistance to thermal fatigue checking, minimizes erosion, wear and "soldering", and prevents battering or deformation of the die surfaces.

Acknowledgment

The author offers grateful acknowledgment and thanks to the New Jersey Zinc Company for permission to use some of the data presented in this article.

Reference

[1]G. E. Werley. "A study of die design changes for the improvement of the soundness and uniformity of test bars." *Trans. Soc. Testing Materials*, **37**, I, 223–254 (1937).



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PLATING ON ZINC BASE ALLOY DIE CASTINGS

Including Buffing, Cleaning and Stripping

C. F. NIXON

FISHER BODY - TERNSTEDT DIVISION
GENERAL MOTORS CORPORATION - DETROIT, MICH.

This presentation will be confined to methods presently employed by Fisher Body-Ternstedt Division. It should be considered as a progress report since there is still considerable room for improvement. Included also will be some comment on experimental work which has been performed in our laboratory.

We supply plated die castings, mainly, to Fisher Body and to the automotive divisions of General Motors. This discussion, therefore, will be concerned largely with die castings intended for this application.

It is interesting to note that since the beginning of what we now call the zinc base die casting industry, in about 1917, considerably more than half of all die castings have gone to the automotive industry. In 1925, Marc Stern—in an article entitled "Die Castings in the Automobile Industry" published in the magazine *Foundry*—estimated that 75% of all die castings were used in automobiles. In August 1946, the United States Bureau of Mines indicates that 17,191 tons of high purity zinc were used for zinc base die casting alloys. Of this tonnage, about three-fourths, it is estimated, finds automotive application. About three-fourths of the die castings used on automobiles are chromium plated—and of these about three-fourths are used on the outside of the car. (Figures from R. E. Wilcox, Gerity-Michigan Die Casting Company.)

Having in mind that very few plated zinc base die castings are subjected to out-of-door exposure except on automobiles, one may say that about a third of all zinc die castings are used in this manner.

In the late twenties when the introduction of chromium plate so greatly improved the appearance of plated parts, particularly those placed on the outside of the car, the use of plated parts for trim increased. At the same time, attention was focused on failures due to rusting or other corrosion. The importance of plate thickness with respect to durability was soon recognized. In 1926 the General Motors Class A specification for nickel-plated steel parts simply read: "Nickel-plated parts shall withstand twenty-four hours in a salt spray test without appearance of rust on significant surfaces". In 1930 was added the requirement that the minimum plate thickness shall be at least 0.001 inch. In 1932 this thickness requirement was extended to cover die castings.

Opportunities for the application of die castings increased with the trend toward more exterior trim. However, and it was a matter of importance, on die castings the thickness of the plated deposit could not be readily increased. The high sulfate-high *p*H double salt nickel bath then employed for direct nickeling of die castings practically could not be used to build deposits heavier than about 0.0003 inch. In addi-

tion, great difficulty was experienced in completely covering parts which were at all complicated in shape. These things hindered the desired development of the use of die castings and perplexed the plater with problems which he did not have the means to solve. It was logical and imperative that attention should turn to copper as an undercoat, even though it was generally reported to be unsuitable because of absorption by the zinc alloy.

References to the use of copper plate as a first deposit on zinc base die castings may be found in the literature as early as 1921. However, to my knowledge, copper plate was not used in production for this purpose before 1930 at which time Ternstedt plated Cadillac die cast door handles in this manner.

The introduction of copper plate made it possible, first, to plate die castings of complicated shape successfully and, second, to apply a total plate thickness sufficient to assure reasonably good performance out-of-doors. Failures due to absorption were found not to be serious at normal temperatures if a minimum of 0.0002 inch of copper is maintained for outside exposure. For interior exposure even 0.0001 inch minimum seems quite satisfactory according to experience over a number of years.

Because of the facility with which parts may be copper plated, the use of the copper strike has come into general use for all parts including interior die cast hardware even though deposits of nickel heavier than 0.0002 inch are not required for satisfactory corrosion resistance on such parts.

At the present time, Class A which calls for a minimum total plate thickness of 0.001 inch—the same, it may be noted, as it was in 1932—is most generally specified and should, if properly applied, give satisfactory performance for a year out-of-doors in industrial atmospheres. This point is discussed in some detail in a paper prepared by the author and published in the November, 1945 issue of THE MONTHLY REVIEW.

The trend at the present time is toward heavier deposits, Class AA (0.0015 inch total) and Class AAA (0.002 inch total), for still better corrosion resistance. The experience with cars which have been used continuously during the war period has made us all more conscious of the need for plating quality for performance out-of-doors. At the same time that we strive for improved corrosion resistance, we must continuously keep an eye on the cost of producing the desired finish.

Polishing and Buffing

The as-cast die castings are die trimmed to remove them from the sprue and runners. Any flash which has appeared at the die parting line is trimmed off at the same time. Following this operation, the part is polished to remove surface irregularities remaining from the trim operation; it may also be polished to remove defects in the surface of the casting. After the polishing operation, the parts are buffed to a high lustre and are then ready for plating.

In order to minimize the cost of this preparation for plating and also in the interests of the quality of the finished piece, the die caster strives to produce a casting free from surface imperfections. Aside from the polishing necessary to repair the surface damage done by trimming, a good die casting requires no polishing whatever. Buffing should be the only operation required to prepare it for plating.

It may be desirable to enlarge somewhat on this statement. The General Motors Corporation has sponsored what is to date a series of two Joint Industry Conferences on Zinc Base Die Casting Quality which were attended by Corporation representatives and representatives of the leading zinc producer and of many of the principal companies engaged in the production of die castings. These conferences were inspired, in part, by complaints that the difficulty of producing acceptable plated parts at a price was greatly increased by surface defects which required polishing for their removal or reduction. The following interesting conclusions may be drawn from these conferences: First, that die casters recognize the need for smooth castings free from surface defects and, second, that while the gating of a die must be still considered an art, sufficient knowledge is available of the

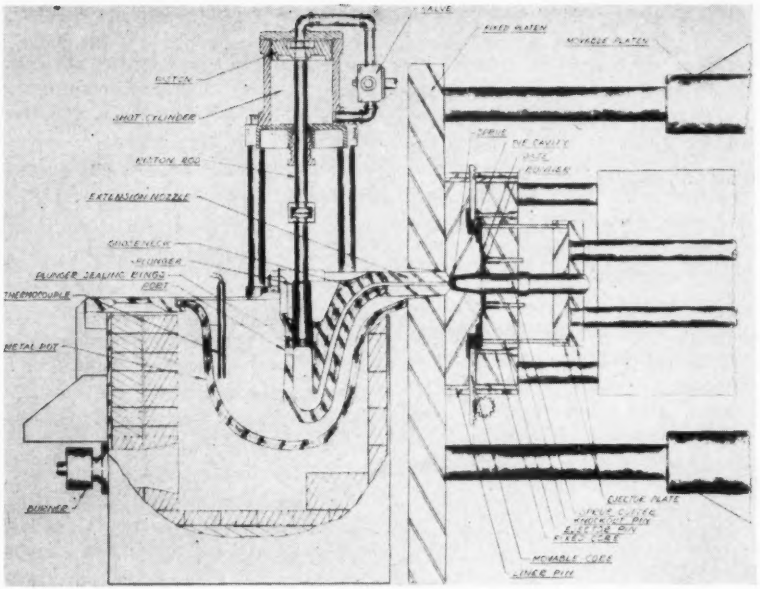

Fig. 1. Front end of typical die casting machine

principles of gating as well as die casting machine operation and metal control that, for the most part, the finisher may with fairness demand and expect castings with smooth sound surfaces.

Fig. 1 represents the cross section of the front end of a typical die casting machine. The molten metal held in the metal holding pot enters the gooseneck through the ports. When the plunger is forced down, the ports are first sealed off by the plunger, after which the metal contained in the gooseneck is forced through the sprue and the runners into the die cavities. When the cavities have been filled, the pressure is maintained for a few seconds until the metal in the cavity solidifies; then the die is opened and the complete shot—sprue, runners and castings—is removed.

The quality of the surface of the casting,

Fig. 2. Chills in die castings

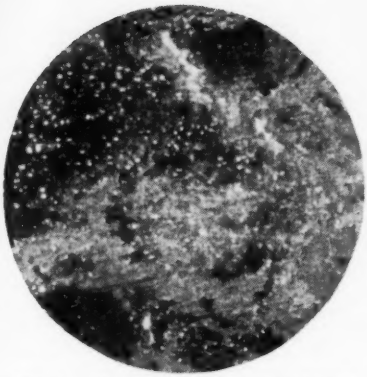

Fig. 3. Chills in die castings, enlarged

which so greatly influences the labor required to prepare for plating and also the quality of the finished piece, is affected by the quality of the metal used and its temperature, the plunger pressure, the speed with which the cavity is filled, the design of the sprue, runners and gating, the location of cavities in the die, the surface of the die cavity and the temperature of the die.

Without going into detail as to the specfic effect of the above factors, suffice it to say that the casting defects most troublesome to platers are chills (Figs. 2 and 3), swirls (Fig. 4), cold laps (Fig. 5), splashes (Figs. 6 and 7), gate holes (Fig. 8) and "soldering" (Fig. 9).

Since these defects occur on significant surfaces, it is usually necessary to remove them by polishing. It is well known that die castings, by virtue of the process by which they are made, have a thin, dense outer skin below which the metal is coarser grained and more porous (Fig. 10). When polishing, carried out to remove surface defects, cuts through this skin, the underlying defects thus revealed may well be as troublesome as those for which polishing had been used as a corrective measure.

Fig. 11 is a photograph of four door handles as they are removed from the die casting machine, still attached by means of the runners to the central sprue.

Fig. 12 is a photograph of one of these handles after trimming. The irregularities

Fig. 4. Swirls in die castings

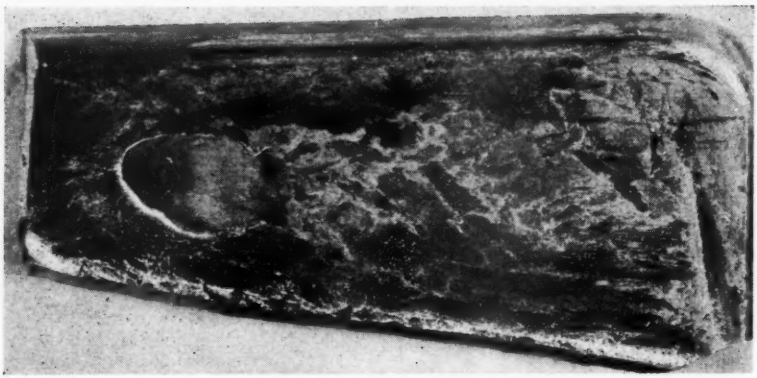

Fig. 5. Cold laps in die castings

at the parting line surface are typical of all die castings. Polishing is required to smooth this surface and to remove casting defects which it may be necessary to accept on other significant surfaces. The door handle after polishing is shown in Fig. 13 and after buffing in Fig. 14.

Polishing is done by means of a sheepskin wheel coated with glue and emery, usually 180 or 220 grit, or by means of an emery belt which may be driven either by a hard wheel or, if a more flexible polishing surface is desired, by a cloth buff wheel. Grease is applied to the wheel to prevent loading or glazing, to reduce friction, to increase the life of the abrading surface and to improve the quality of the ground surface.

Buffing is done on cloth wheels ten to fourteen inches in diameter, sewed as the nature of the particular job demands—which is usually determined by experiment or experience with previous similar jobs. A tripoli compound is used. Wherever possible, automatic equipment (Figs. 15-17) is employed in preference to hand polishing or buffing (Fig. 18).

Cleaning

The cleaning before plating is undoubtedly the plater's most difficult problem. Dr. O. P. Watts of the University of Wisconsin, now retired, used to tell his students in electroplating that plating was 90% cleaning. Although he did not have zinc base die castings in mind, not many platers will dispute his figure even now unless to make it higher.

Fig. 6. Splashes in die castings

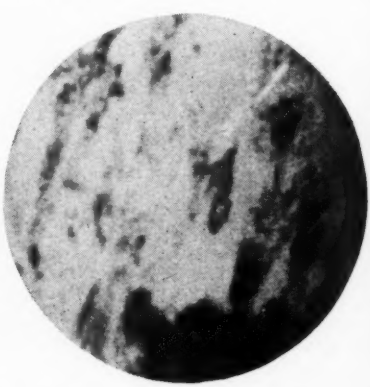

Fig. 7. Splashes in die castings, enlarged

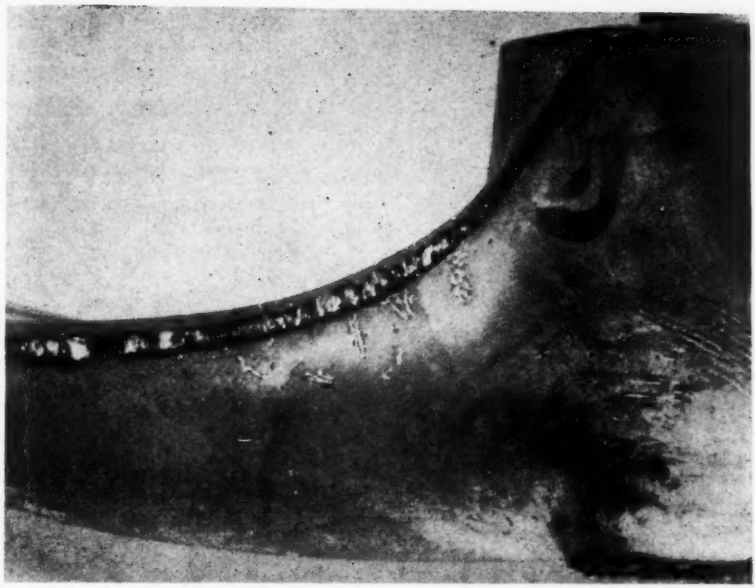

Fig. 8. Gate holes in die castings

Buffed die castings, particularly those which have been buffed automatically, are sometimes very dirty. Buffing compound has a way of filling cavities and recesses which is troublesome to the plater. All such soil must be removed with minimum chemical action on the die casting if subsequent plating is to be successful. Anderson and Reinhard, in a paper published in the March 1940 issue of THE MONTHLY REVIEW and entitled "Alkaline Cleaning and Copper Blistering", emphasized the fact that a copper deposit is prone to blistering when applied to die castings that have been exposed overlong in an alkaline cleaning solution or in too strong a cleaner.

In order to remove the soil without chemical effect, we begin our cleaning process with trichlorethylene degreasing. A so-called three-phase degreaser, which combines vapor degreasing with hot trichlorethylene spraying, serves to remove all or almost all of the foreign material from the part. The equipment is of the monorail type. Wherever possible, parts are placed on plating racks before degreasing

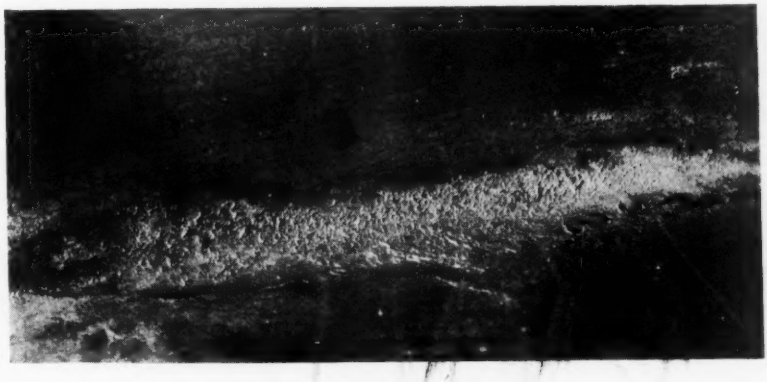

Fig. 9. "Soldering" in die castings

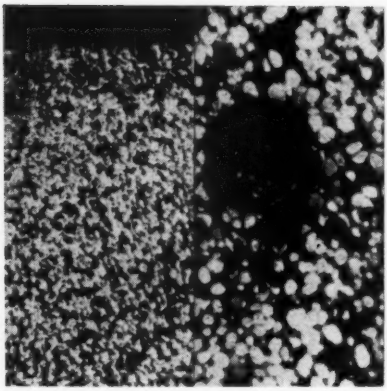

Fig. 10. Structure of die castings. Left: fine, dense structure of skin Right: coarse porous structure below skin.

to minimize handling.

The degreaser may be relied upon to remove the polishing compound binder pletely (unless it be in some very tightly packed crevice), but occasionally some of the solids of the buffing compound will remain on the work. This must be removed by hand brushing; the brief alkaline cleaning which follows will not take it off.

The balance of the cleaning and plating cycle may be carried out in still tanks or, given sufficient volume of production, in automatic plating equipment (Fig. 19). In either case the sequence of operations is essentially the same, although sometimes it may be necessary to modify conditions in the tanks to adjust the process to the time cycle of an existing plating machine.

The alkaline cleaning is done in a solution containing two or three ounces of a

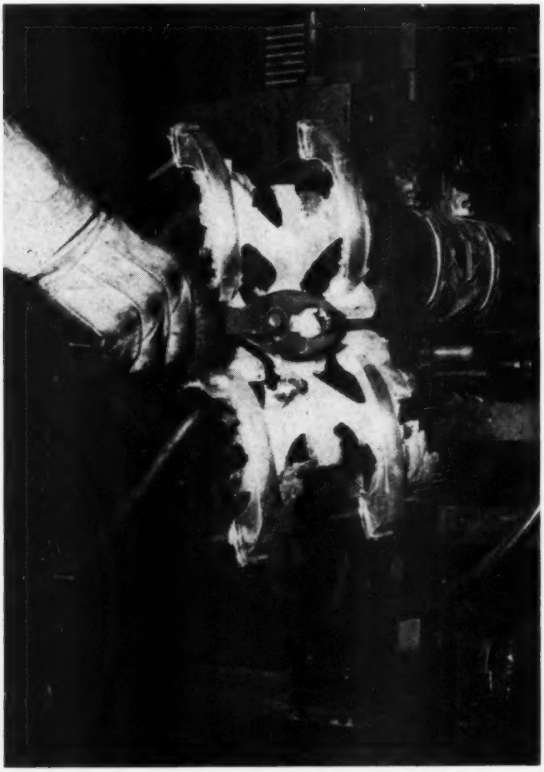

Fig. 11. Four door handles with runners and sprue as removed from die casting machine

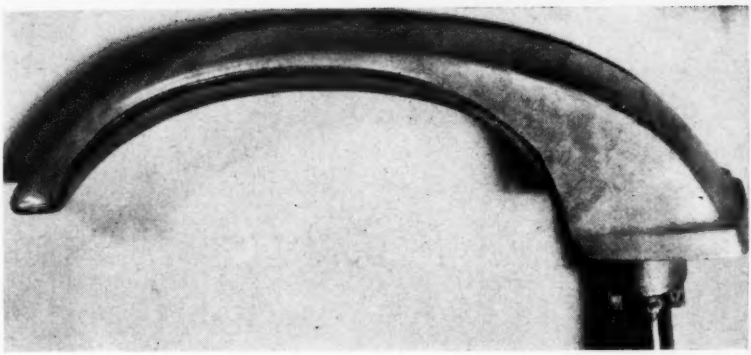

Fig. 12. Die cast handle after trimming

cleaner of the composition shown in Fig. 20. This is one of the G. M. specification cleaners. The temperature is approximately 200° F. The work is anode, and the anode to cathode voltage is about six volts. When fresh, this cleaner would serve its purpose used as a direct cleaner. Reverse cleaning is preferred, however, because the effects of contamination with chromium, zinc and copper salts are less. It is not felt that the formulation of the cleaner given is critical. Undoubtedly, it could be varied within quite wide limits and still perform satisfactorily. Because of the possible contamination referred to above, this cleaner is renewed frequently.

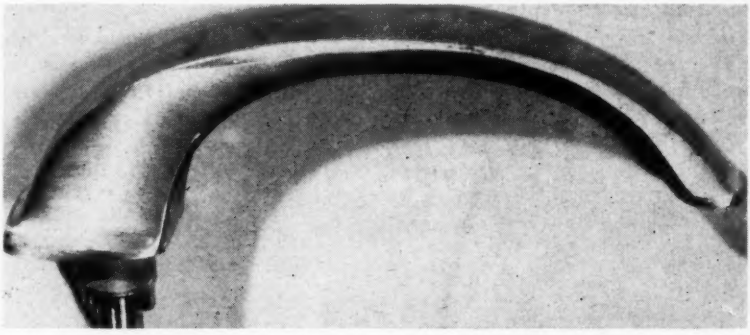

Fig. 13. Die cast handle after polishing

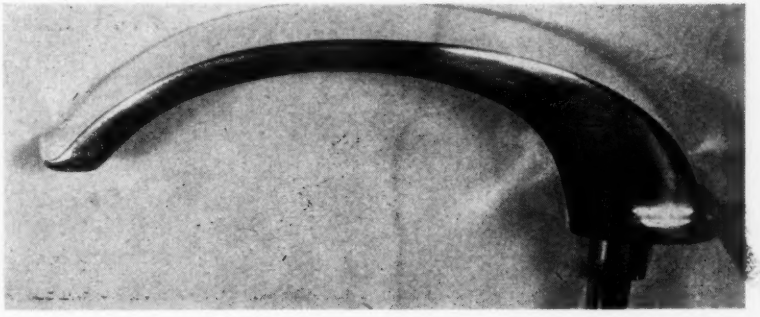

Fig. 14. Die cast handle after buffing

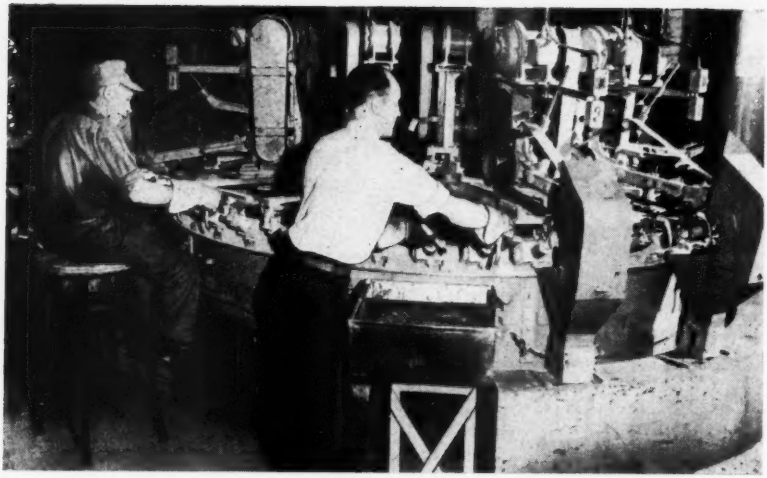

Fig. 15. Automatic belt polishing machine, rotary type

Strictly speaking, the operation just described may not be as much a cleaning operation as a chemical treatment operation. The work, as it enters the cleaner, has been degreased and usually appears quite clean. However, parts taken directly from the degreaser to the copper strike tank will fail due to poor adhesion of the copper deposit.

Having been alkaline cleaned, the work is rinsed in cold water, and immersed for 20 or 30 seconds in a 1½% sulfuric acid dip. It is then rinsed again and is ready for the copper cyanide deposit.

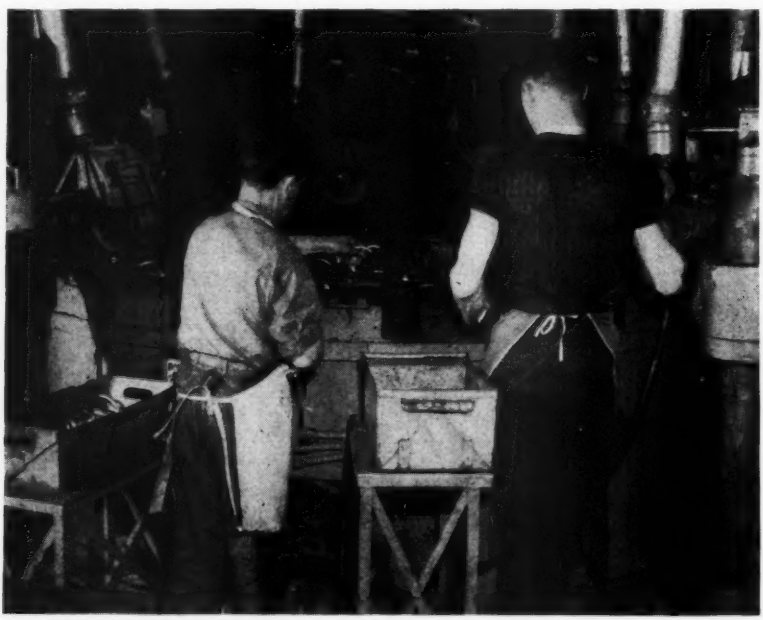

Fig. 16. Automatic buffing machine, rotary type

Fig. 17. Automatic buffing machine, straight-line type

At various times, other acids than sulfuric have been successfully employed. There are some advantages in the use of a weak hydrofluoric acid dip, but they are not sufficient, in our opinion, to offset the hazards involved in the handling of concentrated hydrofluoric acid incident to the preparation of the dip.

Fig. 18. Hand buffing

There is an important relationship between the strength of the acid dip and the intensity of the alkaline cleaning. When it is necessary to use a strong cleaner or to clean for a long period of time, then it also seems necessary to increase the acid strength and the time of acid dipping. However, it seems safe to say that, in general, both the cleaner and the acid should be as weak and of as short a duration as possible. For a particular set of circumstances, it will be necessary to establish concentrations and time periods by experiment. With the sequence of cleaning and acid dipping given above, the die casting is but slightly grayer in appearance as it comes from the acid dip than it was when it went into the cleaner.

Plating

The copper strike solution contains 2½ to 3 ounces of copper cyanide and ¾ to 1 ounce of free cyanide per gallon (Fig. 20). In addition, 1 ounce of sodium hydroxide and from 4 to 6 ounces of Rochelle salts per

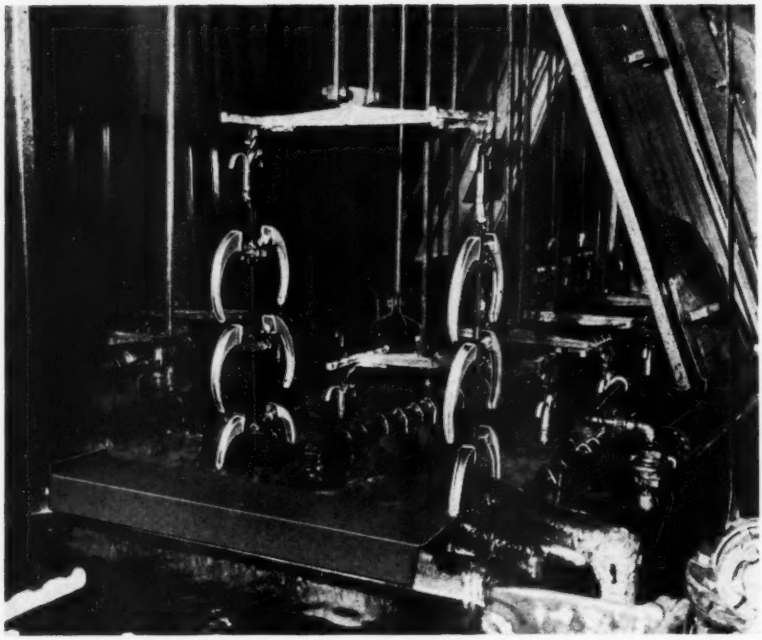

Fig. 19. Section of automatic plating machine

gallon are added to insure proper anode corrosion. The solution temperature is maintained at 100 to 115° F. Some steel anodes are used with the copper anodes in sufficient quantity to prevent rise in copper concentration. It is important that the copper content be kept within the prescribed limits in order that the deposit be sufficiently bright or smooth. Under these operating conditions, the sodium carbonate content will not increase excessively. The sodium carbonate content should be kept at less than 15 ounces per gallon. The current density usually employed is between 20 and 30 amperes per square foot. The time of plating in the cyanide bath may run from 5 to 10 minutes. It is not considered desirable to attempt deposition of much more than 0.0002 inch of copper in this bath if bright deposits are to be used over it without buffing.

MEDIUM DUTY CLEANER—G. M. 2421-M

GENERAL: This specification covers a medium duty metal cleaner composed of Soda Ash, Trisodium Phosphate and Caustic Soda. (For Recommended Applications see Chart, Page 0-35.)

CHEMICAL COMPOSITION IN PERCENTAGE:

Soda Ash	55.00
Trisodium Phosphate	25.00
Caustic Soda	20.00

SODA ASH: The soda ash should be a dry, fluffy ash and must conform to General Motors specification 1803-M.

TRISODIUM PHOSPHATE: The trisodium phosphate must conform to General Motors specification 1804-M.

CAUSTIC SODA: The caustic soda must conform to General Motors specification 1806-M.

Fig. 20. Composition of cleaner for zinc base die castings

	Solution:		
		Analysis	Make up 1000 gal.
Copper Cyanide GM 1851-M	Copper Cyanide	2.5 oz./gal.	160#
	Sodium Cyanide	—	190#
	Free Cyanide	1 oz./gal.	—
Sod. Hydroxide GM 1806-M	Sod. Hydroxide	1 oz./gal.	65#
	Rochelle Salts	6 oz./gal.	375#
	Sod. Carbonate	2 oz./gal.	125#
The solution should be analyzed weekly for all the above constituents, except Rochelle Salts, and appropriate additions made. Supplementing this, free cyanide should be analyzed each shift and additions made.			
Copper cyanide is added by withdrawing solution from the plating tank, making a slurry with the copper cyanide and returned to the plating solution.			

Fig. 21. Composition of copper strike for zinc base die castings

On the completion of the copper strike operation, the desired thickness of deposit in copper or nickel or both may be applied

as on any other base metal. In order to reduce cost, there is an increasing tendency to use bright copper deposits and bright nickel deposits followed by chromium plate without buffing either the copper or the nickel. This obviously is not essential to the production of a satisfactorily plated die casting, but it does completely eliminate the hazard of cut-throughs during buffing and, of course, does hold down cost.

Parts which are carried from one plating operation to the next without intermediate buffing are not ordinarily unracked until after chromium plating. Under these conditions, even though the greatest of care be exercised, it is not always possible to prevent the contamination of cleaning solutions with chromium referred to above.

Therefore, before racks are used again, it is desirable to strip them anodically in a sodium carbonate solution so as to remove as much of the residual chromic acid and chromium as possible.

Stripping

There is no altogether satisfactory method known for stripping of heavy deposits of copper and nickel from die castings. The best method with which the writer is acquainted is the sulfuric acid strip. As a result of considerable experimental work, a concentration of 50 to 55% was settled upon as being best. The stripping action is reasonably rapid on both nickel and copper while the attack on the die casting ordinarily is not excessive. The recommended temperature is 150° F, the voltage 9 volts. If the concentration of acid is increased, the rate of attack on the copper becomes quite slow and, when the base metal is reached in certain portions of the piece, attack on the die casting may be severe before the balance of the copper has been removed.

Additions of glycerine have been tried but are not recommended. Not only is there no appreciable improvement in the quality of the stripping, but there is an increase in hazard because glycerine causes foaming. The foam bubbles contain both hydrogen and oxygen which may be exploded by a spark. Such an explosion may splash acid. Many other addition agents have been tried, such as mannitol, ethylene glycol and formic acid, without finding any that contributes significantly to the performance of straight sulfuric acid.

There are other satisfactory means available for removal of copper only, but they are not applicable when the copper has been nickel plated. Immersion in a polysulfide bath or anodic treatment in a sodium cyanide-sodium sulfide bath, among others, will serve this purpose.

Acknowledgment

Acknowledgment is made to members of the Fisher Body-Ternstedt staff for assistance in the preparation of this paper—notably R. C. Olsen, A. W. Sundwick and E. Mohr.

C.I.C. To Hold Protective Coating Conference - March 14

A conference of interest to all those engaged in the manufacture or use of protective coatings will be held in Montreal, Quebec, on Friday, March 14 in the Mount Royal Hotel. This is the Eastern Regional Conference of the Protective Coatings Group of The Chemical Institute of Canada. The conference is to last for one day only, and among the papers to be presented are:

"Selection of Protective Coatings", K. G. Compton, Bell Telephone Laboratories

"Anodic Coatings on Aluminum and Their Protective Value", D. M. McLachlin and H. P. Goddard, Aluminum Laboratories, Limited

"Applications for Thermosetting Resins in Other than the Surface Coating Industry", E. S. Bauer, Monsanto Chemical Company

"Esterification", C. Y. Hopkins, National Research Council

"Metal Lacquers", J. K. Speicher, Hercules Powder Company.

A detailed programme will be available shortly.

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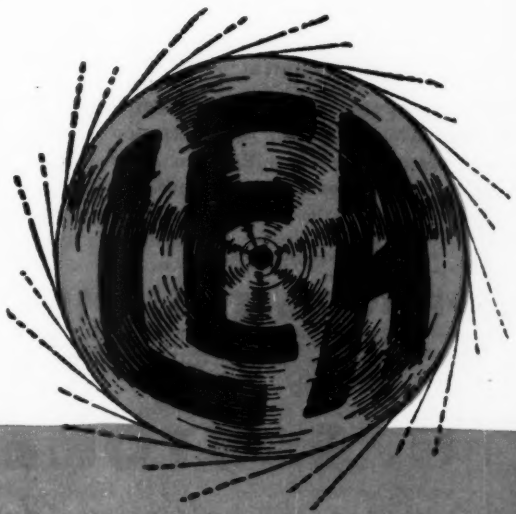

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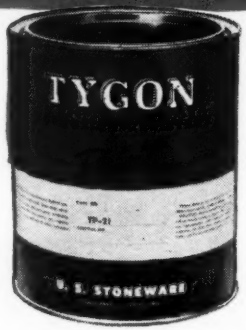

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PROCESS EQUIPMENT DIVISION

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Akron 9, Ohio

TESTING OF PLATED COATINGS ON ZINC BASE ALLOY DIE CASTINGS

E. A. ANDERSON

RESEARCH DIVISION - TECHNICAL DEPARTMENT
THE JERSEY ZINC COMPANY (OF PA.) — PALMERTON, PA.

The subject assigned to me contains the general problem of evaluating the plated coating after it has been produced. The evaluation may be for the purpose of determining whether the coating satisfies the limits set forth in the specification under which it was produced, or it may be an attempt to predict the performance of the plate in actual service. Both viewpoints must be considered in any discussion of the meaning and value of tests.

In the last analysis, the testing of plated coatings is done in order to be sure that the product under test will perform satisfactorily in the intended service. Service usually means atmospheric exposure and, in Detroit, automotive use. A clearer picture of the usefulness of the more common tests and an indication of the need for at least one additional test may result from the examination of actual service experience in this field.

Study of Exposed Car Parts

We have recently completed a study of plated zinc alloy die cast parts taken from 1941 model cars used in Chicago. These parts had had about five years of service. They were produced in an era of shortages and substitutions and hence were expected to include variables not ordinarily encountered. The parts selected included every plated unit then made in zinc die castings except the grille.

From each part one or more areas were selected for study. In each area the thickness of coating was determined by the microscopic method with direct measurement of the magnified image at 1000X. The extent of corrosion in the same place was evaluated by an experienced observer on a numerical scale ranging from 1 for perfect to 7 for very badly corroded (Fig. 1). The adhesion of the coating was determined by the use of a sharp knife at the sawed edges. This test has certain limitations to be discussed later, but the clear-cut trends in the adhesion data indicate that it was satisfactory for the present purpose. Those coatings which could not be removed or which could be removed only in small patches and with difficulty were classified as satisfactory in adhesion. All others were rated unsatisfactory.

The data obtained are plotted in Fig. 2. The solid dots represent coatings having satisfactory adhesion while the open circles represent those which did not adhere satisfactorily.

Effect of Coating Thickness

The most cursory inspection of Fig. 2 reveals a definite relation between coating thickness and plate service in which the service improves as the plate becomes thicker. This confirms, of course, the results of similar observations made on plated panels exposed continuously by the Research Committee of the American Electroplaters' Society and by individuals. This observation brings us immediately to the first and most important test of plated

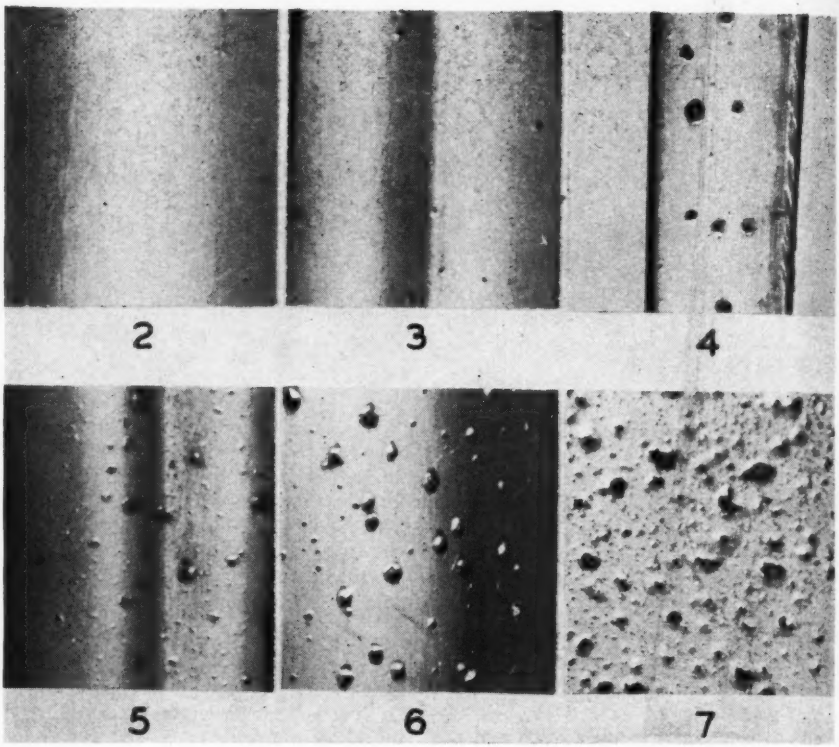

Fig. 1. Corrosion rating key. Full scale

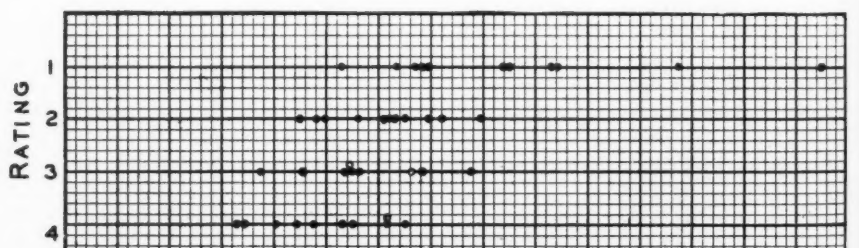

Fig. 2. Corrosion rating vs coating thickness on 1941 cars used in Chicago

coatings—the measurement of the coating thickness.

A. S. T. M. specifications for plated coatings recognize only the microscopic method for measuring coatings on zinc alloy die castings other than chromium. Those of you who participated in the early Joint Committee activities will remember that at that time the best available information placed the error in measuring coatings by this method at ±10% of the value determined. The best alternative methods incurred probable errors of ±15 to 20%.

It is my own belief that the time is ripe for a reconsideration of methods for determining coating thickness. That the A. E. S. feels the same way is demonstrated by the fact that the Research Committee has set up Project No. 7 at Pennsylvania State College to study the problem. Subcommittee III of Committee B-8, A. S. T. M., is also giving the matter attention. Out of all of this work should come a clearer picture of the advantages and disadvantages of the various possible methods.

Importance of Adhesion

A second examination of Fig. 2 reveals a pattern of distribution of the open circles which is worthy of attention. It will be noted that these open circles which denote areas of unsatisfactory adhesion tend to fall to the right of the solid circles denoting areas of good adhesion. The two points far to the right of the main plot represent areas of extremely poor adhesion. This state of affairs may be stated to mean (1) that heavier coatings are required for equal service when the adhesion is poor, or (2) that the performance is poorer for equal thickness of coating. In either event, it is apparent that adhesion of the coating is a variable to be reckoned with in the evaluation of plated zinc alloy die castings.

It is not unexpected that poor adhesion should detract from good service performance. Since the mechanism of failure involves the lifting of the plate by the pressure of zinc corrosion products under it, it is understandable how poor adhesion permits this lifting to take place at an earlier time with a lesser amount of pressure of corrosion products.

There are at present no widely used adhesion tests suitable for specification use. Dr. Ferguson's good work on Project No. 3 of the Research Committee uncovered many methods of test, but none was found which can be operated with sufficiently good control so as to produce readily interpreted results.

The knife test used in our own work has probably had the widest acceptance. It has certain deficieneies, however, which prevent its use for specification purposes. In the first place, the ease with which one can lift a poorly adherent plate with the knife is related to the sharpness of the knife, the roughness of the saw cut, the shape of the part, and the thickness of the coating. Heavy coatings are more readily detached by this means than very light coatings. Where the coating can be lifted, one is certain that the adhesion is poor. Where it cannot be lifted, one is left with the uncertainty of whether the adhesion is truly good or one has merely been unable, for one reason or another, to lift a detachable plate. Even though a satisfactory test is not at hand, it seems desirable that attention be given to this matter of adhesion.

Proper Die Casting Composition Vital

A final look at Fig. 2 discloses three points (circled) with corrosion ratings of 7 which carried a sufficient weight of coating to justify the feeling that better performance should have been had. The coatings were adherent and seemingly normal in all respects. When the microspecimens cut for coating measurements were examined, however, the cause for the early failure was clearly evident. Fig. 3 shows an area of plate failure in a coating with normal behavior. Fig. 4 shows a similar area in one of the three parts under consideration. The fine hair-line markings adjacent to the corroded area represent intergranular corrosion. Intergranular corrosion, which is caused by improper composition of the die casting, causes an increase in dimensions of the casting and hence increases the ease with which early plate failure can occur.

The composition of the casting repre-

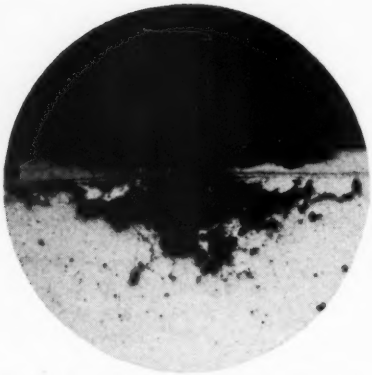

Fig. 3. On-grade casting—no intergranular corrosion. 250X

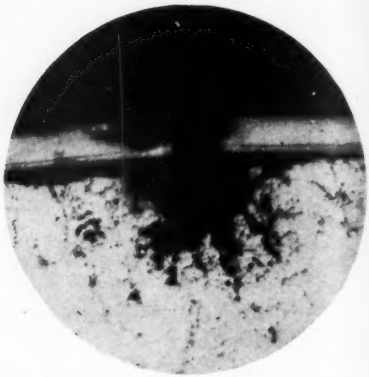

Fig. 4. Off-grade casting—intergranular corrosion. 250X

sented in Fig. 3 was found by analysis to be acceptable. The casting represented in Fig. 4 as well as the other two involved in the three encircled points in Fig. 2 contained less magnesium and more lead than is acceptable under any of the specifications for zinc die casting alloys. The intergranular corrosion noted here would be expected in alloys of such composition. It probably is unnecessary for me to repeat that these castings were made during the period of shortages and substitutions just before the war. Such deviations from specification limits are uncommon in normal times. However, the plater should be aware of their importance since it is now clear that there is a definite connection between alloy composition and plate performance.

Mechanism of Plate Failure

There has been a certain amount of mystery about the mechanism of plate failure which has caused some confusion in the interpretation of data from accelerated porosity tests. Microexamination of a number of plated parts taken from actual service on automobiles reveals the fact that the plate itself is subject to a pitting type of corrosion which gradually eats through until the underlying metal is exposed. Typical pits are exhibited in Figs. 5 and 6. An excellent example of complete penetration with extensive corrosion of the underlying zinc is shown in Fig. 3.

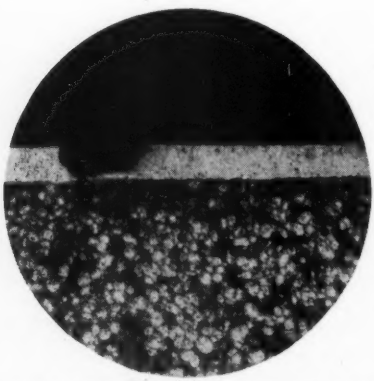

Fig. 5. Typical corrosion pit in nickel plate. 500X

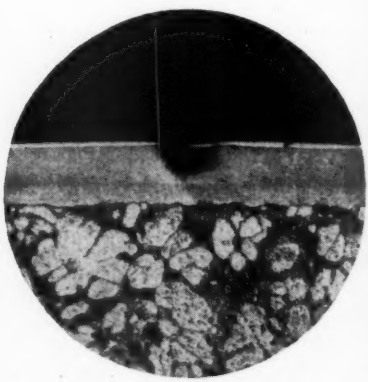

Fig. 6. Typical corrosion pit in nickel plate. 500X

Since the process is one of plate corrosion, it is logical to believe that the basis metal makes no direct contribution to this phase of plate failure. Evidence to this effect is seen in Fig. 7, which shows pitting penetration in nickel plated brass.

Fig. 7. Corrosion pitting in nickel-plated brass. 500X

The real mystery lies in the question of whether this corrosion pitting takes place in sound coatings or is facilitated by pores, basic salt inclusions and other discontinuties in the plate. The probable answer is that both modes of penetration are involved. Certainly, there are some actual openings through the plate that coincide with defects in the die casting. Typical cases of such openings are shown in Figs. 8 and 9.

Fig. 8. Plate defect caused by casting defect. 500X

It is obvious, however, that a part which has reached the stage of failure corresponding to a corrosion rating of 7 could not possibly have had that many casting defects so uniformly distributed. There could, however, have been that many weak spots in the plate due entirely to factors involved in the plating operation, such as basic salt inclusion, etc. The work under way under Project No. 6 of the Research Committee should answer some, if not all, of these questions.

Even though we do not know the mechanism by which atmospheric moisture eats holes in plated coatings, we do have enough information to make a preliminary assessment of our current methods of testing for plate porosity. These comprise the well-known salt spray test and various porosity tests such as the ferroxyl test.

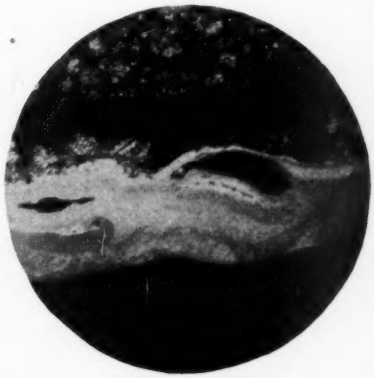

Fig. 9. Plate defect caused by casting defect. 500X

Where an actual opening exists through the plate due to a defect in the underlying metal, almost any electrolyte should be capable of penetrating to the zinc and make the presence of the opening obvious by producing zinc corrosion products or plate blisters. There is no reason to believe that the salt spray test is any less capable in this respect than any other test. If the only intent of porosity testing is to detect actual holes in the plate traceable to casting defects, the salt spray test should be adequate.

The Porosity Test

Experience has shown absence of success wherever an attempt has been made to correlate the rate of formation and the number and distribution of corrosion blisters in the salt spray test with those observed during outdoor exposure. This is understandable if we assume that the salt spray test primarily detects defective spots while the outdoor atmosphere either makes its own openings or finds weaknesses which the salt spray test cannot detect.

Certain of the contact type porosity tests such as the iodide test investigated by P. W. C. Strausser while at the Bureau of Standards apparently are capable of eating holes through the plate at a different rate and probably in different locations from those produced by the atmosphere. We are confronted, therefore, by the problem of first deciding whether we wish to detect only defects in the plate which might result in rapid local failure in service or to conduct a test capable of duplicating in a short time the range of failures found in the outdoor atmosphere. If the former is desired, the salt spray test under good control is probably as good a method as any. If the latter is desired, we shall probably have to look further for a test capable of corroding the plate in a manner similar to that produced by the atmosphere. The acetic acid-salt spray test described by C. F. Nixon is a possible answer to the problem which deserves careful attention.

W. M. Tucker New Vice-Chairman of Research Directing Sub-Committee

Dr. R. M. Wick, Chairman of the Research Directing Sub-Committee, announces the appointment of William M. Tucker of the Eastman Kodak Company, Rochester, N. Y., as additional Vice-Chairman of the Research Directing Sub-Committee. He will divide the load now carried by Dr. Louis Weisberg, Consultant Chemist of New York City.

The Vice-Chairmen will take on additional responsibilities for the direction of the Research Projects, thereby lessening Dr. Wicks' burden.

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DETERMINATION OF IMPURITIES IN ELECTROPLATING SOLUTIONS

A. E. S. Research Project No. 2

V. Manganese In Nickel Plating Baths

EARL J. SERFASS
Project Director

W. S. LEVINE
Associate

Lehigh University, Bethlehem, Pa.

Acknowledgment is due the Research Committee, Mr. E. C. Candee, American Brass Company, Chairman; the Research Directing Sub-Committee, Dr. R. M. Wick, Bethlehem Steel Corporation, and Dr. Louis Weisberg, Consulting Chemist, New York City, Chairman and Vice-Chairman respectively; and the Project Sub-Committee, Dr. D. Gardner Foulke, Foster D. Snell, Inc., Chairman, and Dr. Walter R. Meyer, The Enthone Company, for their contribution to this project.

Summary

The manganese is oxidized to permanganate by sodium periodate in an acid mixture of phosphoric and perchloric acids. The transmission of the solution is then measured with a Klett-Sommerson Colorimeter with green filter No. 54.

Introduction

The colorimetric determination of manganese by oxidation to permanganate in acid solution is so sensitive, specific, and simple in procedure that it should be readily applicable to the determination of manganese in nickel plating baths which may also contain appreciable quantities of aluminum, cadmium, chromic oxide (CrO_3), iron, lead, zinc and calcium.

Other colorimetric methods have been used, but none has had the success of the permanganate method. With manganic compounds, a yellow color is developed with o-tolidine in the absence of chlorine[3]. Manganates react with benzidine to produce a brilliant blue-green color. This is very sensitive reaction[11,1,13]. However, the color is produced also by other oxidizing agents and is not very stable. Manganese reacts with tetramethyldiaminodiphenylmethane to give a deep blue to violet colored solution[4,5,12]. Again, any strong oxidizing agent will give the same reaction with the reagent. Another quantitative method for manganese is based on the reaction of formaldoxime with manganous ions[10] in which a brown-red color is formed.

To oxidize the manganese to permanganate in acid solution, various oxidizing agents have been used. Lead dioxide and sodium bismuthate were found satisfactory, but the excess reagent had to be removed by filtration. Ammonium persulfate plus silver as a catalyst is widely used, but a true permanganate color is not always obtained, and it is difficult to tell when oxidation is complete. The best oxidizing agent appears to be sodium or potassium

periodate. It oxidizes the manganese, and then the excess periodate stabilizes the color for months if kept in the dark[6,14,8].

Manganese is oxidized according to the equation

$$2MnSO_4 + 5KIO_4 + 3H_2O \rightarrow 2HMnO_4 + 5KIO_3 + 2H_2SO_4$$

The oxidation is carried out in strong acid solutions containing nitric, sulfuric, phosphoric or perchloric acid. Usually mixtures are used. If much iron is present, sulfuric or phosphoric acid must be present to prevent the precipitation of ferric periodate. Phosphoric acid decolorizes the ferric iron and also prevents the possible precipitation of periodates or iodates of manganese[9]. Sulfuric acid can be replaced by equivalent amounts of perchloric acid. For information on the effect of acidity and acids on the oxidation, the reader is referred to papers by Willard and Greathouse[14] and Richards[15].

Most impurities, with a few exceptions, do not interfere except when they are colored. The effect of copper, nickel and chromate ions can be compensated for by the use of a blank containing similar amounts of these metals. Silver, lead and mercury will give no precipitates if enough acid is present, but bismuth and tin do even in very strong acid solutions[7,9].

Developmental Work

Since the conditions under which manganese is quantitatively oxidized to permanganate by alkali periodates are so well known, little trouble was anticipated in applying the reaction to the determination of manganese in plating baths.

Only two points seemed to warrant some preliminary investigation:

(1) The destruction of organic matter in plating baths and the removal of chlorides and reducing agents which react with permanganate.

(2) As the method desired is to be applicable in the presence of appreciable quantities of the trace elements mentioned previously, how would they affect the development of the permanganate color?

The first problem was easily solved by adding a mixture of nitric and perchloric acids to an aliquot of the bath and heating to fumes of the latter.

Determination of Impurities in Electroplating Nickel

TABLE I
Calibration Curve Data

Manganese Added gamma	Readings	Average Reading	Blank	Corrected Average Reading	Mean Average Reading
0	27–20–22	23	..	..	23
0	23–24–21	23	..	..	
50	35–36–36	36	23	13	
50	34–36–34	35	23	12	12
50	30–33–31	32	23	9	
100	44–44–45	44	23	21	
100	46–48–43	46	23	23	22
100	44–45–42	44	23	21	
200	69–67–67	68	23	45	
200	68–68–68	68	23	45	45
200	66–68–67	67	23	44	
500	134–137–137	136	23	113	
500	139–141–134	138	23	115	112
500	133–128–133	131	23	108	
1000	258–252–248	253	23	230	
1000	242–250–243	245	23	222	226
1000	253–252–242	249	23	226	

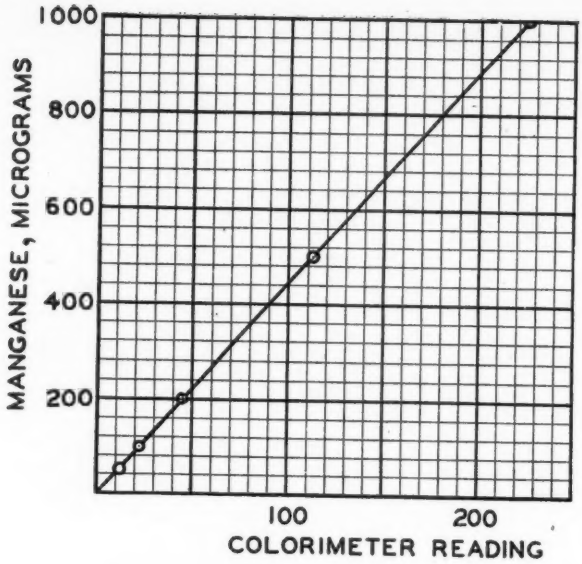

Fig. 1. Calibration curve for the determination of copper in a Watts type nickel bath as copper diethyldithiocarbamate in a mixture of amyl acetate and ethyl alcohol. Instrument used: Klett-Sommerson colorimeter with blue filter No. 42. Type of cell: test tube. Final volume of solution: 25 ml

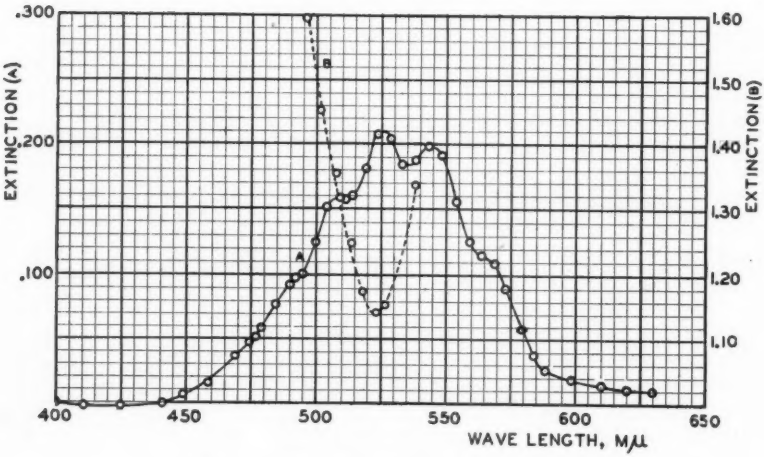

Fig. 2. Extinction vs wave length for (A) copper diethyldithiocarbamate containing 50 micrograms copper in 25 ml, (B) Klett-Sommerson filter No. 42 (extinction units on the right)

Of the ions to be present in the bath, only copper, chromate and nickel ions can possibly interfere. Their presence can be compensated for by the running of a blank and proper selection of the wave length of the incident light.

Preparation of the Calibration Curve

Having eliminated all apparent difficulties, a procedure based on preliminary tests and methods recommended by other investigators [8,9,14] was worked out.

In order to check the accuracy and precision obtainable by this method, a calibration curve was prepared covering the range of 0 to 1000 micrograms of manganese. This was done by pipetting 0.5, 1, 2, 5, and 10 ml quantities of a standard manganese solution respectively into five 200 ml flasks containing 10 ml of a pure synthetic Watts type plating bath. A sixth flask containing a similar portion of the bath served as the blank. The recommended routine procedure given near the end of the paper was then followed, beginning with step (2), to develop the permanganate color.

TABLE II

Kind and Quantity of Ions Added to the Plating Bath

Metal Ions Added	Quantity mg	Concentration g/l
Aluminum	100	1.0
Cadmium	100	1.0
Chromic trioxide (CrO_3)	20	0.2
Copper	20	0.2
Iron	100	1.0
Lead	5	0.05
Silicon	100	1.0
Zinc	100	1.0
Calcium	Saturated	Saturated

The colorimeter readings obtained on using a Klett-Sommerson colorimeter with the No. 54 green filter are tabulated in Table I.

The calibration curve prepared by plotting the mean average readings against the corresponding amounts of manganese is shown in Fig. 1. The straight line shows that Bouguer-Beer's law is obeyed by the permanganate solution at least over the concentration range tested. It is supposed to hold for concentrations up to 150 ml/l.

To obtain maximum sensitivity in the determination of manganese by this method, the incident light should have a wave length of about 525 millimicrons because transmittancy curves for permanganate solutions such as the one shown in Fig. 2 exhibit maximum absorption at this wave length. Therefore, when a filter photometer is used, the maximum transmittancy of the filter should be for light of about this wave length. Fig. 2 also shows the transmittancy curve for the green filter used in this investigation. It exhibits maximum transmission between 525 and 540 millimicrons and hence is satisfactory for this work.

Determination of the Accuracy and Precision of the Method

To check the possible accuracy of the method under conditions similar to those which are likely to be met in industrial

TABLE III

Accuracy Test

Manganese Added gamma	Readings	Average Reading	Blank	Corrected Average Reading	Manganese Recovered gamma
0	29–27–28	28	28	..	..
50	37–38–39	38	28	10	43.0
200	75–75–72	74	28	46	200
300	97–96–94	96	28	68	310
500	146–145–143	145	28	117	520
700	195–190–187–191	191	28	163	720
1000	260–262–258	260	28	232	1020

practice, small amounts of various metallic salts were dissolved in 100 ml of the pure nickel plating bath. This solution was then used in testing accuracy and precision instead of the pure bath employed in the preparation of the calibration curve.

Table II shows the metallic ions and the amounts added. When possible, these metals and compounds were added to the bath as the solid chlorides, sulfates or nitrates. All the salts dissolved except the calcium. The solution was heated, shaken thoroughly, allowed to cool, and then filtered.

The procedure is the same as that used in the preparation of the calibration curve. Table III shows the results obtained on single runs.

TABLE IV

Results Obtained by Different Laboratories

Laboratory	Manganese mg/l
A	56.0
B	55.0
C	49.5
D	55.0

To get an additional check on the accuracy of the proposed procedure, a quantity of a standard solution of manganese was added to the synthetic bath used in the above accuracy tests so that each milliliter of the bath contained 50 micrograms of manganese.

Portions of this solution were sent to three laboratories which kindly consented to check the recommended procedure. They were the Research Laboratory of the International Nickel Company, Inc., Bayonne, N. J.; Foster D. Snell, Inc. of Brooklyn, N. Y., and the Bethlehem Steel Company of Bethlehem, Pa.

The results obtained by these laboratories and the writers on this sample are shown in Table IV.

In testing precision, four duplicate runs were made with 500 gamma of manganese using the same procedure as followed in the preparation of the calibration curve. The results presented in Table V show that the method has good precision.

Recommended Routine Procedure

The procedure adopted for the determination of manganese in nickel-plating baths is the following.

TABLE V

Precision of Procedure

Manganese Added gamma	Readings	Average Reading	Blank	Corrected Average Reading	Manganese Found gamma
500	147–147–142	145	28	117	520
500	149–140–141	143	28	115	510
500	147–139–143	143	28	115	510
500	146–145–143	145	28	117	520

Except for the sample containing 50 gamma of manganese, the accuracy is better than 10 per cent. It will be noted that the results are somewhat high. Note, too, that although the amount of nickel present in this test was the same as that used in preparing the calibration curve, there is a difference of 5 scale divisions in the blanks. This was probably due to the presence of the small amounts of copper, iron and chromate added.

REAGENTS REQUIRED:

1. *Concentrated Acids*—c. p. Grade Perchloric (70 to 72%), nitric (sp. gr. 1.42), phosphoric (95%).
2. *Sodium periodate (solid)*—c. p. Grade.
3. *Sodium bisulfite solution*—30 per cent.

Add about 3 grams of the salt ($NaHSO_3$) to 10 ml of H_2O and shake thoroughly. This amount will just about saturate the solution.

4. *Standard manganese solution*—100 micro-

grams/ml.

Dissolve 288 milligrams of purest reagent grade potassium permanganate in 100 ml of 2% by volume sulfuric acid. Add sodium bisulfite dropwise until the solution becomes colorless. The solution is now diluted to one liter and mixed well. Each milliliter contains 100 gamma of manganese.

5. Synthetic Watts Type Nickel Plating Bath

Dissolve 330 grams $NiSO_4.7H_2O$, 45 grams $NiCl_2.6H_2O$ and 30 grams boric acid in pure distilled water to make one liter of solution. The nickel salt should be of A. C. S. Analytical Reagent quality.

Apparatus Required

10 ml pipette—accurately calibrated
Three 50 ml burettes
200 ml Erlenmeyer flasks
Small glass spoon
Klett-Sommerson colorimeter with No. 54 filter or any other suitable photoelectric colorimeter or spectrophotometer. Any filter showing maximum transmittancy around a wave length band of 525 to 550 millimicrons can be used.

Procedure

Oxidation of Reducing Agents

1. Place 10 ml of the plating bath into a 200 ml Erlenmeyer flask.

2. Add 2 ml of nitric acid, evaporate to salt formation and then add 15 ml of perchloric acid. Heat the flask until fumes of $HClO_4$ are being copiously evolved.

3. Cool, and dilute to 70 ml with distilled water. When all the salts are redissolved, add 5 ml of phosphoric acid.

4. Add with the small glass spoon approximately 0.4 gram of solid sodium periodate, heat almost to boiling, and digest at this temperature for about 10 minutes.

5. Cool, transfer the solution to a 100 ml volumetric flask, dilute to the mark with distilled water, and shake thoroughly to mix.

Measurement of the Transmittancy of the Unknown

6. Using a clean test tube cell partially filled with distilled water as the reference liquid, adjust the colorimeter so that the galvanometer pointer is at the zero position when the dial reading is zero.

7. Pour out the water, rinse the test tube a couple of times with small portions of the test solution in the flask, and then partially fill the test tube with the sample. Replace the test tube in the colorimeter and rotate the dial until the galvanometer pointer returns to its original position. Record the scale reading.

8. Run a blank following the same procedure except for the addition of the periodate, and correct for the periodate as described below under "Calculations".

9. From the calibration curve, note the quantity of manganese corresponding to the corrected scale reading of the test sample and calculate the amount of manganese in the bath.

Calculations

Suppose the scale reading for a 10 ml sample of the bath is 191 and that the blank reading is 28. Then 191 − 28 = 163 is the corrected scale reading for the sample. According to the calibration curve, a reading of 163 corresponds to 0.71 mg of manganese. Since the 0.71 mg is present in 10 ml, the concentration of manganese in the plating bath is 0.71 x 100 = 71 mg/l or 71 ppm or 0.071 g/l.

It is possible to eliminate the need for calibration curves if a solution is known to transmit light in accordance with Bouguer-Beer's law and if the instrument used has a logarithmic scale. Run an unknown, a standard, and a blank. Correct the unknown and the standard for the blank as described. Since the readings for both the standard and the unknown are directly proportional to the concentration of manganese, the concentration of manganese in the unknown is calculated by using the formula:

$$\frac{\text{concentration of standard}}{\text{corrected standard reading}} \times \text{corrected unknown reading} = \text{concentration of unknown.}$$

Discussion of Procedure

Reducing substances and chlorides that

can react with periodate or permanganate must be destroyed or driven off. Hence, the first step is to oxidize all the reducing agents present. In this procedure, the oxidation is accomplished by adding a mixture of nitric acid and perchloric acid to the sample and boiling until fumes of the latter are evolved. This treatment will oxidize any reducing agents such as ferrous iron, sulfites and nitrites and will volatilize chlorides.

"Stop and Go" Method for Manganese

The method of oxidation and development of the permanganate is the same as that given above in the recommended routine procedure. A blank and unknown are carried through the same procedure and transferred to Nessler tubes. Small portions of a standard potassium permanganate solution containing 100 micrograms/ml of manganese are then added until the solutions in the two tubes match in color. The detailed procedure is as follows:

Procedure

Oxidation of the Sample and Development of the Colored System

1. Pipette 10 ml portions of the bath into two separate 200 ml Erlenmeyer flasks. One will serve as a blank.

2. Starting with step (2) of the Recommended Routine Procedure proceed in the same way up to and including step (4) except that no sodium periodate is added to the blank.

3. Cool the solutions, and transfer them to 100 ml Nessler tubes.

Comparison of the Colors

4. Dilute the unknown to the 100 ml mark and the blank to about 95 ml. Shake.

5. Now add 1 ml of the potassium permanganate solution to the blank, shake well and compare the color of the blank with the color of the sample viewing them horizontally against a white background.

6. Continue adding portions of the permanganate solution to the blank, until the colors in the two tubes match. The amount of manganese is then determined from the volume of potassium permanganate required to match the color of the sample.

Calculations

Suppose 6.5 ml are required. Since each ml is equal to 100 micrograms of manganese, there are 6.5 x 100 = 650 micrograms or 0.65 mg of manganese in the 10 ml of nickel plating bath taken for analysis.

0.65 x 100 = 65 mg/l or 0.065 g/l of manganese in the bath.

The method is accurate to at least 50 gamma.

Color Chart

The chart of color changes shown in Table VI may be used as a rough guide if one does not care to run a blank.

TABLE VI

Color Chart

Color of Sample	Manganese micrograms	Notes
green	0	
blue green	100	solution
blue green	200	becomes bluer
gray blue	300	
gray blue	400	
purplish blue	500	solution gradu-
purplish blue	600	ally becomes
purplish blue	700	more purple
blue purple	800	blue shade
blue purple	900	disappears
blue purple	1000	gradually

Applicability of the Method to Other Types of Plating Baths

The method was tested on chloride, 50–50, and high sulfate baths as well as on a Watts type bath and found to give satisfactory results.

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Analysis of Gold and Gold Alloy Solutions
A Correction

Dr. Edward A. Parker, the author of the above entitled article which appeared in the January issue, has drawn our attention to three errors that were overlooked in the manuscript.

In the beginning of line 8 the bottom of column 1, page 35, add "Add 250 ml water and . . ."

Change line 27 of column 2, page 35, to read "Ml of arsenious oxide solution x 0.0974".

Change line 30 of column 2, page 35, to read "Ml of arsenious oxide solution x 0.040 x gold".

We regret these mistakes.

Volume Designations in the Monthly Review

The following information is given to avoid confusion in the ordering of photostats of articles which have appeared in The Monthly Review.

It should be noted that each issue was paged separately up to and including Volume 23, 1936. Hence references to articles in issues published before 1937 must include designation of Issue No. or month to be complete.

Vol.	1	June 1914–May 1915
	2	June–Dec. 1915
	3	1916
	4	1917
	5	1918
	6	1919
	7	1920
	8	1921
	9	1922
	10	1923
	11	1924
	12	1925
	13	1926
	14	1927
	15	1928
	16	1929
	17	1930
	18	1931
	19	Jan. 1932–July 1933*
	20	Sept. 1933–July 1934*
	21	Aug. –Dec. 1934
	22	1935
	23	1936
	24	1937
	25	1938
	26	1939
	27	1940
	28	1941
	29	1942
	30	1943
	31	1944
	32	1945
	33	1946
	34	1947

*The issues for October, 1932, January, April, and June, 1933 are called The Quarterly Review, not to be confused with the Quarterly Review of A. E. S. of which Nos. 1–3, Vol. 1 were issed between June–August 1913 and December, 1913–February, 1914, or with the Quarterly Review of the National Electro-Platers' Association, of which three volumes were issued prior to June, 1913.

Be Foresighted — and Whistle!

PRUDENTLY prepare for the stormy winds of March and you can go merrily on your way, comfortable, serene, and of good cheer.

Foresightedness in the protection of your plating cycle tanks from the ravages of corrosion will also pay dividends in satisfaction and in the enjoyment of trouble-free operation.

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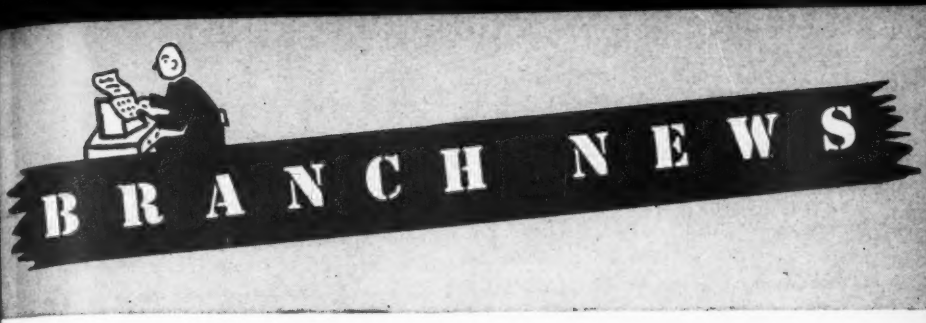

Coming Events

NEWARK BRANCH

A cordial invitation is hereby extended to our members and friends to attend our Annual Winter Open Educational Session scheduled to be held on March 7 at 7:30 P. M. in the Robert Treat Hotel, Newark, N. J.

In keeping with our endeavor to maintain contact with the rapid progress in our industry, we have again been fortunate in obtaining outstanding speakers who are well qualified to present the following timely subjects:

MR. JOHN KREML, Rustless Iron and Steel Company, Baltimore, Md., "Electroplating of Stainless Steel"

MR. W. L. HULTS, Schneffel Brothers Company, Newark, N. J., "The Economic Aspects of Electropolishing"

MR. ALBERT E. HOWE, Federal Telephone and Radio Corporation, Newark, N. J., "An Introduction to Electropolishing".

These open meetings, under the able leadership of ZACHARY IRENAS, have been well attended in the past.

All engaged and interested in electroplating and its allied sciences are heartily welcomed.

WILLIAM F. BRUHNS,
Educational Committee.

●

BUFFALO BRANCH

An invitation is extended by the Buffalo Branch of the American Electroplaters' Society to attend its Annual Educational Session and Dinner Dance on Saturday, March 22 in the Markeen Hotel, Buffalo, N. Y.

The Educational Session starts at 2:30 P. M.—the Dinner at 7:30 P. M.

"Finishing of Aluminum", illustrated with a movie, *Dateline Tomorrow*, is the subject of MR. RALPH E. PETTIT of the Aluminum Company of America at the afternoon session.

For reservations write MR. CHARLES W. LOGAN, General Chairman, 48 Nassau Avenue, Kenmore, N. Y.

●

NEW ENGLAND REGION

The Eighth Annual New England Regional Educational Session and Banquet will be held in New Haven, Conn., on April 26.

The Technical Session is scheduled for 2 P. M.—the Banquet for 7 P. M.

Make your plans to attend now.

H. L. KELLNER.

●

BOSTON BRANCH

The Boston Branch will hold its 12th Annual Educational Meeting and Banquet on March 22 at the Hotel Statler, Boston, Mass.

The Speakers will be:

W. M. PHILLIPS
M. M. BECKWITH
W. H. JACKSON

Subjects to be announced.

The meeting will start at 1:30 P. M. sharp with a 30-minute question and answer period directed by DR. GEORGE P. SWIFT.

Everyone is cordially invited to attend, members and non-members alike. Reservations should be made immediately.

For hotel reservations, write WALTER L. LARSON, 1113 Statler Bldg., Boston 16, Mass.

WALTER L. LARSON,
ARTHUR COLLINS,
Publicity Committee.

BUFFALO BRANCH

The December 13 meeting in Hotel Markeen opened with a dinner at 7:00 P. M., after which LIBRARIAN CHARLES LOGAN introduced the guest speaker, DR. WALTER R. MEYER of the Enthone Company. Dr. Meyer gave a very interesting lecture on "Preparation of Metals for Electroplating," a subject of great interest to all.

Many questions were asked and affably answered by Dr. Meyer. A lengthy discussion followed the adjournment of the meeting.

Refreshments were served and some of the boys played penny ante while others formed quartets and sang Christmas Carols. A very good time was had by all.

J. RUFF,
Acting Secretary.

●

HARTFORD BRANCH

MR. DONALD A. HILLIARD of Landers, Ferry and Clark, New Britain, Conn., was the featured speaker at Open Meeting on January 20 at which HARRY SANDERS served as technical chairman.

Mr. Hilliard's subject, "Organic Finishes", was dealt with largely from the standpoint of testing methods. Other phases discussed included conveyor equipment, which was illustrated with slides, and high frequency de-tearing. The audience asked many questions which were ably answered.

The meeting opened with a dinner attended by twenty members and guests, after which GEORGE B. HOGABOOM presented his always appreciated monthly feature, "Latest Developments". There were forty present at the session.

F. W. SMITH, *Secretary.*

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MONTREAL BRANCH

The February 4 meeting opened with an illuminating address on "The Hull Cell" by MR. P. M. COADY, Chemist of R. C. A. Victor, who recently became a member of the Branch. Mr. Coady demonstrated tests with the Hull Cell on nickel sulfate, nickel chloride and chromium solutions and exhibited test plates of cadmium. Each demonstration was accompanied by a comprehensive explanation. A hearty vote of thanks was extended to the speaker and to MR. J. D. FAIRBAIRN and his staff who assisted.

One application was accepted. The President selected a Nomination Committee of three members.

It was voted that the speaker of each meeting would be the guest of the Branch at dinner on meeting nights.

WILLIAM GLOVER, *Secretary.*

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BUFFALO BRANCH

Not less than 34 members attended the regular monthly meeting on January 14, PRESIDENT SIEBERT JOHNSON in the chair.

LIBRARIAN CHARLES LOGAN, who is also chairman of the Spring Educational Session and Banquet, announced that it would be held on Saturday, March 22, in the Markeen Hotel, Main and Utica, Buffalo, New York.

BILL HART was given a deserving vote of thanks for the very nice Christmas Party that he promoted at the December meeting.

MR. W. A. HELBIG of the Darco Corporation then spoke on "The Purification of Electroplating Solutions by Filtration and Activated Carbon Treatment." Mr. Helbig's very interesting lecture covered the subject thoroughly. Many questions were asked and promptly answered. Mr. Helbig concluded by demonstrating the charging of a small Sparkler filter with activated carbon in which he was assisted by MR. H. CORRODI of Sparkler Manufacturing Company.

J. RUFF,
Acting Secretary.

●

BALTIMORE-WASHINGTON BRANCH

Through the courtesy of KEN HUSTON, a member of the Branch, the January meeting consisted of a tour through the Rustless Iron and Steel Division of the American Rolling Mill Company in Baltimore.

Approximately eighty-five attended. The regular business meeting was dispensed with in order to afford more time for the tour. The interesting operations that were seen included melting, hot rolling of billets and rods, cold rolling of shapes and forms,

grinding, annealing, pickling, sodium hydride descaling, coating before drawing, hot lead coating, copper plating, and wire drawing. It was most striking to see the twelve and twenty five-ton arc furnaces and the hot rolling of billets.

GRACE RIDDELL, *Secretary.*

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CLEVELAND BRANCH

The November 8 meeting of the Cleveland Branch was an outstanding one. High tribute was paid to MR. WALTER L. PINNER, Manager of Research, Houdaille-Hershey Corp., by an unusually large attendance. Many new faces were in the audience. Mr. Pinner provided a very interesting evening with his stimulating discussion of "High Speed Nickel Plating" (THE MONTHLY REVIEW *32*, 227–234 (1945) and *33*, 506-509 (1946)) which he followed with a showing of slides with the results of A. S. T. M. preliminary outdoor corrosion tests on nickel and copper-nickel coatings.

These results were amazing to say the least. Composite coatings of nickel and heavy copper did not show up as well as straight nickel deposits. On the other hand, nickel deposits over a copper flash coating were superior to straight nickel deposits. Comparisons were made with equal total thickness of deposit over SAE 1010 and 1085 steel panels.

A lively question period followed this presentation We wish to thank Mr. Pinner for providing us with so much food for thought in one evening and for many good stories.

MR. STEPHEN F. MILLER of the Quality Plating Co. was appointed local chairman of the Exhibits Committee to work with A. E. S. Third Vice-President, Mr. Arthur W. Logozzo.

Seven new members were elected.

GEORGE B. SVENSON,
Secretary-Treasurer.

●

CLEVELAND BRANCH

The members who attended the December 6 meeting were provided an interesting evening by MR. EDWARD WASHBURN, Electroplating Supervisor, McKinney Mfg. Co., Pittsburgh, Pa. His subject was "Spot Testing" of which he has made a hobby for a number of years. The talk covered the identification of metals and of metallic ions in solution, especially metallic impurities in plating baths. Some of the many metals which were effectively identified were copper, nickel, chromium and tin.

GEORGE B. SVENSON,
Secretary-Treasurer.

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DETROIT BRANCH

Approximately 200 members and guests were present at the January meeting at which over a half a dozen new members were elected.

GEORGE NANKERVIS presented a short progress report on the plans for the June Convention and spoke particularly on the *Metal Finishing Exposition* to be held at that time. Space for the exposition is being sold very rapidly and those who have not already made arrangements should do so now if they wish to utilize this excellent opportunity to show the public as well as the plating trade their wares.

PRESIDENT WRIGHT WILSON then turned the meeting over to MR. GEORGE PILLSBURY, our very capable Librarian.

The motion picture *Copper and Its Alloys*, courtesy Revere Copper and Brass, proved interesting and instructive.

Following this, Mr. Pillsbury introduced our old friend, MR. FLOYD F. OPLINGER, of E. I. DuPont de Nemours and Company, who spoke about "Troubles and Difficulties in Copper Plating from Normal Cyanide Copper Plating Baths." In his highly appreciated talk he covered a number of pertinent points; touching on the difficulty of reducing laboratory research to plant operation, the difference between plating steel and zinc base die castings, trouble with roughness on steel, etc. Research on the straight potassium and sodium baths as well as baths containing both sodium and potassium indicated that the potassium bath was superior. However, except in very special cases, the difference between mixed and straight potassium baths was not great, provided the potassium salts made up at least 50% or more of the total salt concentration. Incomplete rinsing and small amounts of impurities such as chromium,

lead and extraneous organic materials were often a source of trouble.

R. H. DUDLEY,
Publicity Chairman.

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GRAND RAPIDS BRANCH

The members of the Grand Rapids Branch were privileged to hear MR. FRANK K. SMITH, of Technic, Inc., speak on "Novelty Electroplating and Finishes" at the monthly meeting on December 13. Mr. Smith's topic was on a phase of plating somewhat unfamiliar to many of us, as most of the electroplating done in this area is on hardware, ornaments, plumbing fixtures and the like. The methods of producing various types of gold plate were described and rhodium plating was mentioned. Mr. Smith also spoke on methods of racking, rinsing, and drying plated material.

Some members expressed a belief that we could adopt some of the methods used by the producers of novelty finishes and, conversely, that the novelty finishers might profitably examine the methods and materials used in plating hardware and ornaments.

After the meeting had been adjourned, the usual refreshments were served.

R. B. PERKINS, *Secretary.*

●

JACKSON-LANSING BRANCH

Thirty-five members and several guests assembled at the Hotel Porter for the December 10 meeting.

Three applicants were elected to membership. R. W. REDMOND discussed the Annual Educational Session and urged that persons desiring hotel accommodations make them as soon as possible.

Mr. Redmond then introduced DR. R. B. DAVIS, Technical Director of Research Laboratories, E. I. DuPont de Nemours and Company, Flint, Michigan. Dr. Davis presented an outstanding paper on problems in the painting of various metals, with emphasis on those metals with which the electroplater is concerned. A question and answer period followed which developed into an excellent round table discussion of painting problems.

Two films were shown, *The Story of Nickel* from the International Nickel Co., and a privately filmed color picture of sport fishing off Isle Royale, after which a lunch was served.

V. J. FORSYTH,
Secretary-Treasurer.

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HARTFORD BRANCH

The December Open Meeting was held on the 16th in the Hotel Bond. Following a dinner, PRESIDENT TED VOYDA turned the meeting over to RALPH MCCAHAN, Technical Chairman for the evening. After GEORGE HOGABOOM had presented his monthly feature "Latest Developments," MR. BERT SAGE spoke about "Barrel Bright Nickel Plating." He outlined the conditions for successful operations including solution formulae and operating specifications, as well as pre-cleaning, rinsing and drying techniques. The operations must be very closely supervised and controlled if a bright plate is to be obtained consistently. The talk was well received by the 60 members and guests attending.

Refreshements were served immediately following the meeting.

F. W. SMITH, *Secretary.*

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LANCASTER BRANCH

The regular monthly meeting was held Friday, January 10 at the Stevens Trade School. PRESIDENT HAROLD KILHEFFER presided with 17 members and guests present.

Since our first Ladies' Night last December had been a success, another Ladies' Night will be held in April.

A library for establishing a file of back numbers of The MONTHLY REVIEW and the *Annual Proceedings* was discussed. The Secretary was instructed to advise the Executive Secretary that there was no library in this section available for this purpose.

LIBRARIAN NORMAN GEBERT introduced our speaker, MR. WILFRED S. MCKEON, President of Sulphur Products Co., of Greensburg, Pa., who spoke on "Stripping Copper Non-dangerously." A solution of 2 parts of liquid sulphur and 1 part of water at 180° F is used to remove copper from the base metal. After having been immersed in

this solution for about 5 seconds, the work is rinsed and immersed in a solution of 1 lb sodium cyanide per gallon of water at 180–200° F. This cycle is repeated until all the copper is removed. The operation will not attack the base metal, nor is it injurious to the operator. Mr. McKeon, however, did suggest ventilation for large installations. A discussion period followed.

H. Clay Brubaker,
Secretary.

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MILWAUKEE BRANCH

The New Year started with a fine attendance of members. The speaker at the 374th meeting on January 10, Mr. R. T. Frank of The Metallizing Engineering Company, talked on "Metallizing Unlimited" and discussed new developments in techniques and uses. He also displayed the gun used in spraying the molten metals and explained its mechanics.

President William Geissman appointed the following committee for the Annual Banquet to be held at the Schroeder Hotel on April 26, 1947: Frank Marx, Chairman; Axel Johnson, Hotel and Menu; Robert Steuernagel, Jr., Finance; L. Dively, Publicity; Jack Davis, Entertainment; Ted Hartshorn, Education; and Rodney Olsen and Henry Bornitzke, Advisors.

James Durnford,
Secretary-Treasurer.

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MILWAUKEE BRANCH

Over 100 members and guests turned out to hear Dr. Weigandt's talk on "Organic Finishing" at the 373rd regular meeting on December 6. In his talk Dr. Weigandt, who is Director of Research at the Pittsburgh Plate Glass Company, covered as much of the field as was possible in a short time. Some new developments proved very interesting. Practical pointers on such subjects as the effects of the baking time were also given. Everyone left the meeting with new and useful information. The discussion showed the interest in finishing other than plating.

Refreshments were served.

James Durnford,
Secretary-Treasurer.

MONTREAL BRANCH

Nineteen members were present at the regular monthly meeting on January 7, a slight improvement over last month. Mr. H. Roach of Northern Electric Co., a guest, showed much interest by vigorous participation in the Educational Session.

Librarian J. T. Reisenburg conducted the Educational Session and gave a fine talk on "Conductors in the Plating Room." His discussion of methods for the determination of conductivity led to a heated controversy on the current capacity of fine gauge wire.

Wm. Glover,
Secretary-Treasurer.

●

NEWARK BRANCH

Dr. Frederick A. Lowenheim of Metal and Thermit Corporation was the featured speaker on January 3. His talk on "Electrodeposition of Uncommon Metals" was indeed a treat for those present. Of the 94 elements, 75 are metals and about 16 are plated commercially. Dr. Lowenheim spoke about 35 of the uncommon metals, citing authors' names, patent numbers, bath composition and operating conditions as well as presenting an estimate of the future of each as a plating metal. He had prepared samples of most of them; the antimony coating drew most attention with its fine texture and its high brightness after buffing.

Four membership applications were received. One request for transfer to the Cleveland Branch and one resignation were accepted. Election to membership was held up because of the small attendance.

George Reuter,
Assistant Secretary.

●

NEW HAVEN BRANCH

At the December meeting on Tuesday the 10th, President Joseph M. Cook appointed Dr. H. L. Kellner, Jack Barry and Fred Gurnham as a committee to plan a "Social" for the January meeting.

A motion by Ernest R. MacNicholl, seconded by Fred Gurnham, to contribute $100.00 to the A. E. S. Research Committee was unanimously approved.

Technical Chairman JOSEPH L. DOWNES announced the serious illness of a founder of the New Haven Branch, BILL BRIDGETT.

He then introduced MR. ALLEN L. COLEMAN, Chief Industrial Hygienist of the Connecticut State Department of Health, who spoke on the many health hazards associated with plating room operations. He discussed analytical procedures for contaminants and displayed the types of instruments used in their evaluation. MR. LOUIS W. WOODHOUSE, Principal Industrial Hygiene Engineer, showed slides demonstrating the engineering control of hazardous operations.

Joe Downes then conducted a very interesting question period during which the members displayed a universal desire for knowledge on this subject.

B. J. GAFFNEY,
Secretary-Treasurer.

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PHILADELPHIA BRANCH

PRESIDENT ORLIK opened the December meeting with about forty present.

Four applications were referred to the Board of Managers. Five approved applicants were elected to membership.

LIBRARIAN HIRSCH introduced as the speaker, our own President Henry G. Orlik, Chief Plating Chemist of RCA Camden Plant, whose subject was "Practical Methods of Testing Plating Solutions."

A practical demonstration of how to use a Spiral Cathode in testing zinc solutions for impurities gave rise to a spirited discussion of the relative merits of the spiral, the right angle cathode and the Hull Cell arrangement. The plater or chemist can develop other similar short cuts or quick tests to check trouble as soon as it arises.

PAUL MENTZER, SR.,
Secretary.

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PITTSBURGH BRANCH

After the customary dinner, at which 28 members and guests were present, the January 16 meeting was called to order by PRESIDENT KELLER in the Avalon Room of the Keystone Hotel. The attendance was approximately 45.

Three applicants were unanimously elected to membership and one application wa referrred to the Board of Managers

A. E. S. Second Vice-President S. S. JOHNSTON discussed the membership campaign.

MR. R. A. DIMON continued his talks on "Fundamental Principles Underlying Electroplating." The subjects discussed were "Operating Conditions" and "Factors Influencing Adhesion."

The principal speaker was MR. GEORGE W. JERNSTEDT of the Westinghouse Electric Corporation, who spoke on "Periodic Reversal of Current in Electroplating." This is the first time that this process has been discussed publicly and our branch is honored to have been the medium of its first presentation. It is one upon which the Westinghouse Company has been working for several years, and it created much interest because of its potentiality for improving numerous electroplating processes.

The process involves an automatic periodic reversal of the polarity of the work being plated (i. e., plate 5 seconds—deplate 1 second). By dissolving away deposited metal at the end of each plating cycle, improvements were reported in respect to lustre and porosity as well as metal distribution. Although most of the data presented dealt with alkaline copper plating solutions, it was indicated that the process could be applied successfully to other electrolytes.

An interesting discussion period followed.

RICHARD A. DIMON,
Secretary-Treasurer.

●

ROCHESTER BRANCH

The monthly meeting was held in Hotel Seneca on January 17.

LIBRARIAN JOSEPH HULL introduced MR. A. S. KOHLER, sponsored by F. Gumm Chemical Company, who spoke on "Tumble Deburring and Tumble Surface Finishing of Metals and Plastics." Mr. Kohler gave a very comprehensive explanation of the mechanisms, materials, and principles in tumbling and burnishing. Samples of tumble-finished brass, aluminum, plastics, etc., were exhibited. There was an unusually large number of people in attendance who

were very appreciative of the evening's fine program.

At the business meeting, there were received three applications for membership and one request for transfer from the Dayton Branch.

ROBERT L. FLINT,
Secretary.

●

SAN FRANCISCO BRANCH

Eighteen members and three guests were present at the regular monthly meeting on January 9.

One application for membership was approved.

The Secretary reported on the proposed class for electroplaters. The University of California Extension Division has signified that it will sponsor such a course of instruction. The members selected Tuesday as the most desirable evening, and decided that, if possible, the course should be given in San Francisco between 7 and 9 P. M. MR. HUNTINGTON was approved as instructor of the class. Subject matter of the course was discussed, and it was decided to limit the course to the basic principles of electroplating.

FRED W. HUNTINGTON,
Secretary-Treasurer.

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SOUTHEASTERN BRANCH

A regular monthly meeting was held at the Robert Fulton Hotel in Atlanta on Thursday, January 9, with 18 members attending.

LIBRARIAN CLEM HOHNER could not report much progress in placing The MONTHLY REVIEW in the Atlanta Library but promised a better report at the February meeting. MR. WOOLFOLK has made some progress as chairman of the Exhibits Committee.

The speaker, MR. WILLIAM H. WILKERSON, President of the Auto-Soler Co. of Atlanta, had for his topic "Dixie, Look to Your Boot Straps," a very good subject enjoyed by all. Mr. Wilkerson, a native Georgian, founded his business in 1932. By hard work, he and his partner, made it a $1,000,000 a year, world-wide business from a shoe string. He claims that there is room for many more successes of this kind here in the South but they require hard work and determination.

WM. T. WEYMOUTH,
Secretary-Treasurer.

●

SPRINGFIELD BRANCH

The January meeting was held jointly with the American Society for Metals on the 20th. A dinner preceded the meeting. The speaker was DR. F. R. MORRAL, Metal Trades Laboratory, American Cyanamid Company, Stamford, Conn. who had for his subject "Corrosion and Protection."

ARTHUR ZAVARELLA of the Springfield Armory was Technical Chairman.

LAURENCE R. FOUNTAIN,
Secretary-Treasurer.

●

TWIN CITY BRANCH

There were thirty persons present at the January 7 meeting in Hotel Dyckman in Minneapolis.

During the dinner PRESIDENT LILLICROP introduced our new members and the following guests: MR. ROBERT PETERSON, JR. and MR. G. HENDRICKSON. It was announced that it is planned to have name cards for the members at the next meeting.

We were pleased to have MR. H. C. NARCUS of Electrochemical Industries speak on "Deposition of Metals on Plastics." Mr. Narcus' talk was very interesting and informative.

ROBERT L. BUCKLEY,
Secretary-Treasurer.

●

ST. LOUIS BRANCH

Following a dinner which was very much relished by a large number of our members, VICE-PRESIDENT ROBINS called the January 8 meeting to order.

BURTON DAW'S motion that those who had not paid their dues should be removed from the membership roll was passed unanimously. As a final attempt to keep as many as possible in the Branch, the name of each unpaid member was called out and some of our members picked several of the names and promised to get in touch with them and tell them to remit their dues.

The meeting was then turned over to LIBRARIAN HAMM who suggested that each member identify himself. He then intro-

duced the speakers of the evening, MESSRS. E. N. SAMPSON and H. E. THOMPSON of the General Electric Co. They spoke about and showed movies illustrating the construction and care of rectifiers, and answered many questions.

EDWARD HUNLETH,
Secretary-Treasurer.

●

ST. JOSEPH VALLEY BRANCH

The regular monthly meeting was held on December 4 in the Empire Room of the Hotel Elkhart, Elkhart, Indiana. Twenty-seven members and guests attended the dinner and thirty-nine the technical session which followed.

Three applications were voted on and accepted. One new application was received.

PRESIDENT HARLAN announced that the Safety Codes Committee has been suspended due to conflict with Building Codes which are now in the House.

LIBRARIAN DR. H. J. WIESNER introduced MR. L. A. CRITCHFIELD, United Chromium Inc., who gave a very interesting talk on pyrophosphate plating solutions.

RAYMOND A. FRIEND,
Secretary-Treasurer.

●

WATERBURY BRANCH

PRESIDENT BERT SAGE, in opening the regular monthly meeting on December 13, advised that we would have a thorough discussion of the proposed changes in the Constitution in March. GEORGE HOGABOOM outlined these changes in considerable detail. He pointed out that they are of vital importance to every member and should be studied carefully as soon as the revision is completed.

Lately, most of our business meetings have been poorly attended. President Sage urged that an effort be made to increase the attendance

HENRY STROW was the technical chairman. He introduced JACK HYNER who received the book *German Plastics Practice*, edited by DeBell, Goggin and Gloor and issued by the Department of Commerce at Springfield, Mass. It is a review of German methods of manufacture and fabrication of plastics.

The movie shown through the courtesy of the Y. M. C. A. was entitled *Building a Tire.*

The speaker of the evening, HAROLD J. RANSBURG of the Harper J. Ransburg Co., described in detail a new electrostatic painting process which saves as much as 75 per cent of the paint sprayed. This process should prove valuable in saving material and labor and assuring better quality of the finished product.

S. L. HENN,
Secretary-Treasurer.

●

WATERBURY BRANCH

PAST-PRESIDENT WALTER PINNER was the guest speaker at the regular meeting on January 10. He first discussed briefly the *Industrial Finishing Exposition* which is to be held during the June Convention, and the revisions to be considered in the Constitution of the Society.

"A New Process of Bright Plating from an Acid Copper Bath" was Mr. Pinner's subject. The usual bath is used to which organic addition agents containing sulphur are added. Cathode agitation is preferred and current densities of 80 asf are average. Samples of bright smooth deposits from this bath were displayed.

Mr. Pinner also showed slides of A. S. T. M. panels from exposure tests made at Kure Beach. In all of these tests, composite coatings of copper and nickel appeared definitely inferior to coatings of nickel alone, although a flash of copper prior to nickel appeared to be beneficial. DR. DUBPERNELL, in commenting on these panels, noted that 0.0001 inch of cyanide copper prior to acid copper plating was not enough to protect the steel from the action of the acid bath. In his opinion, the panels were not properly prepared and, therefore, the results were not indicative of what may be expected from such composite coatings.

In the absence of JACK HYNER, Dr. George Dubpernell reviewed the revised edition of *Finishing Metal Products*, by Simonds and Bregman. This new edition is similar to the last one and contains very little new material. It is very general, written for the purchasing agent or executive who knows little about plating and finishing,

but doesn't contain much of value for the plater. (EDITOR'S NOTE: COMPARE DR. READ'S REVIEW IN THE FEBRUARY ISSUE.)

Our movie was entitled *Three to be Served* and concerned the relationship of capital, labor and the consumer in manufacturing.

HARRY STREETER, as Technical Chairman, conducted the program.

S. L. HENN,
Secretary-Treasurer.

●

SYRACUSE BRANCH

MR. G. A. LUX, Director of Technical Information, Oakite Products, Inc., was the speaker at the meeting on January 17. He was introduced by LIBRARIAN PAUL SWARTZ who pointed out that Mr. Lux was a former member of the Syracuse Branch and a former A. E. S. Research Associate at the National Bureau of Standards. Mr. Lux's subject was "Some Fundamentals of Alkaline Metal Cleaning". The mechanism by which cleaners remove oil and particles was discussed and demonstrated. Other interesting items mentioned by Mr. Lux were the tarnishing of brass by air dissolved in water, the removal of buffing compounds from polished surfaces, and electro-cleaners that reduce chromic acid. A lively question session followed the talk which was greatly enjoyed by the twenty-nine persons in attendance.

One applicant was elected to membership.

N. F. MURPHY, *Secretary.*

●

NEWARK BRANCH

Five applicants were elected to membership at the regular meeting on January 17. There were three new applications.

PRESIDENT JOHN DE VRIES appointed HOWARD COBB chairman of the Branch Research Committee. On a motion by GEORGE WAGNER, seconded by HORACE SMITH, the Branch voted to contribute $200.00 to the Research Fund. The Secretary was instructed to write to the Research Committee and ask that a project be started on gold and silver plating.

LIBRARIAN ZACHARY IRENAS then introduced DR. HERBERT BANDES who gave a most interesting talk on "Nickel Plating". He began with the work of Dr. Isaac Adams, whose double salt bath, including both sulfate and chloride, probably was the first one to be used commercially, in 1869, and who introduced the first soluble nickel anode containing iron and carbon. Among the early developments which still survive are Weston's invention of the low voltage generator in 1874 and his introduction of boric acid into the nickel bath. Dr. O. P. Watts' paper on Electrodeposition of Nickel and Cobalt in 1915 changed the course of nickel plating; his bath formula is used with little change for all modern bright nickel solutions.

Dr. Bandes also discussed the structure and mechanical properties of nickel; the nature of the cathode film; why bright nickel brightens; the effect of metallic impurities and other similar subjects.

GEORGE REUTER,
Assistant Secretary.

●

BRIDGEPORT BRANCH

There were thirty-five members and guests at the regular monthly meeting on January 3.

FRANK KALAFUS gave a progress report on the Branch Exhibit to be shown at the Industrial Finishing Exhibition in Detroit. WILLIAM EHRENCRONA presented the program for the Old Timers' Night to be held on February 7.

One new member was elected and there were two applications for membership.

The Branch expressed its sympathy to V. S. CONSALVO at the passing of his father.

PRESIDENT H. M. GOLDMAN and A. R. MCNEIL agreed to attend a meeting in Waterbury on January 18 at which arrangements for the Annual New England Regional Meeting were discussed.

LIBRARIAN CARL SCHAEFER would investigate the situation at the local library as to THE MONTHLY REVIEW and *Proceedings.*

Through the generosity of A. R. McNeil, $14.00 was realized in an effort to regain part of the loss incurred at the outing at Eichner's Grove.

Librarian Schaefer then conducted the Technical Session Period which he introduced by a talk dealing with electropol-

ishing of stainless steel, silver and copper, and bright nickel plating barrels. A lively discussion followed.

JOSEPH G. STERLING,
Secretary-Treasurer.

●

BRIDGEPORT BRANCH

PRESIDENT H. M. GOLDMAN opened the Open Meeting and Educational Session on January 17 which was attended by seventy members and guests.

LIBRARIAN CARL SCHAEFER, who was the Technical Chairman of the evening, introduced MR. RALPH E. PETTIT of the Aluminum Company of America. Mr. Pettit has been the Development Engineer for Finishes with this company for about twenty years and is an acknowledged authority on the "Alumilite Process". He described methods and processes for the production of a variety of finishes and illustrated his lecture with slides and with a large display. A sound motion picture, *Dateline Tomorrow*, also was shown during this most interesting session.

JOSEPH G. STERLING,
Secretary-Treasurer.

●

PHILADELPHIA BRANCH

PRESIDENT ORLIK opened the January meeting with sixty-five present.

Four men were elected to membership, and eleven applications were received.

LIBRARIAN HIRSCH introduced KENNETH M. HUSTON, First Vice-President of the A. E. S. and Research Engineer, Rustless Iron and Steel Division, American Rolling Mill Company, whose subject was "Electropolishing of Stainless Steel". MR. JOHN KREML assisted with a small-scale demonstration.

The speaker started by asking the Branch to study the Revised Constitution prior to the Convention; and reminded the members to give all copies of THE MONTHLY REVIEW and the *Proceedings* that they can spare for distribution to libraries of other Branch cities.

Mr. Huston's paper covered bath composition, including the wetting agent necessary to make the process safe for health, current density, bath temperature and cathode composition. The limitations of the solution were cited, especially the low throwing power which compares to that of chromium solutions. While he was speaking, Mr. Kreml polished samples brought by the members.

Many questions were asked during the talk and answered to the satisfaction of all.

PAUL MENTZER, SR., *Secretary.*

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TORONTO BRANCH

The regular monthly meeting was held on January 10 with over forty members and guests present. The appetizing fluid that went with the dinner was donated by JOHN ACHESON of Canadian Hanson and Van Winkle Company. The lucky draw prize of twenty-five buff sections was won by John Acheson who still wonders how the donor, CURGAN WELLS of W. W. Wells, Limited, was able to obtain "this brand".

It took less than fifteen minutes to conduct the business and hear the various committee reports. BENNY CAMERON gave a final report on the successful Fall Dance and turned over to the Treasurer the profits, $116.16.

For the educational section of the program, one of our own members and a Past-President of the Branch, MR. ARCHIE SMITH, Sales Engineer for the Unions Screen Plate Company, Lennoxville, Quebec, gave an extremely interesting and descriptive talk on "Industrial Applications of Heavy Nickel and Hard Chrome Electrodeposits". By the use of a great many lantern slides he expertly showed the variety of work being plated, and the modern, well-equipped plant where it is done. The numerous jobs shown included such parts as rolls up to fifteen tons in weight and thirty feet in length, precision plated screen plates for the paper industry, drying rolls, rams, dies, moulds, etc. Many of the pictures showed the parts in use in a wide variety of industries such as dried milk, paper, rubber, laundries and printing plants.

Many questions were asked, and expertly answered by Mr. Smith. Everyone was well satisfied that the evening was really worthwhile and gave a hearty vote of thanks to both the speaker and MR. H. BUTTERILL,

Corrosion Engineer of the International Nickel Company, who operated the lantern.

J. L. VAUGHAN,
Review Correspondent.

●

LOS ANGELES BRANCH

Seventy-one meals were served at the dinner preceding the regular meeting on January 13. It is estimated that approximately one hundred persons attended the meeting, among them thirteen guests.

C. E. STOUGHTON, Warrant Officer, U. S. Marine Corps, who has been on duty in China during the past year, attended.

CARL R. KLINEFELTER, recently discharged from military service, has been restored to active status in the Society.

MR. HARTVIG J. MOLL of Hanson-Van Winkle-Munning Company, discussed at some length the subject of "Automatic Conveyers". He mentioned economic considerations, practical problems, and advantages to be derived from automatic installations. He followed with a presentation of a motion picture film serving himself as narrator. The film was titled *Automatic Conveyors* and illustrated the operations in four typical industries manufacturing chrome furniture, aircraft propeller spiders, automobile bumper bars, and typewriters.

PRESIDENT ELDRED reported as Chairman of the Annual Session and Banquet Committee that LIBRARIAN GILBERT EXTALE has obtained four speakers for the Annual Session: M. H. ORBAUGH of Bone Engineering and Tool Company and ELBURN D. MARCUM of du Pont Company, both of this branch, and MR. DICK LORD of General Electric Company and MR. DICK SCOTT of Udylite Corporation, Detroit.

Four newly elected members were initiated. There was one in-transfer.

This Secretary, reporting for the L. A. Public Library Committee, read a letter from Executive Secretary A. K. Graham announcing that all back issues missing from the library files back to 1915, and possibly to 1913, will be supplied and also that some *Annual Proceedings* were on the way. This good news was welcomed with enthusiasm and President Eldred commended all persons whose efforts had born such excellent fruit.

E. R. HOLMAN,
Secretary-Treasurer.

●

CHICAGO BRANCH

The regular monthly meeting of the Chicago Branch was held on January 10.

MR. WILLIAM P. COLEMAN of the George A. Stutz Manufacturing Company provided a very interesting moving picture of the history of copper and its applications from its earliest origin to the present day. Any other Branch having interest in this picture can obtain it upon application to Ampco Corporation, Milwaukee, Wisconsin.

About 105 were in attendance and showed much interest in the topic.

In the absence of our Librarian, MR. JOSEPH ANDRUS of Croname, Inc., conducted the question box.

G. STUART KRENTEL,
Review Correspondent.

●

CHICAGO BRANCH

The Chicago Branch held its Annual Educational Session and Dinner Dance on Saturday, January 25, at the Stevens Hotel. About 500 attended the Educational Session which consisted of a Symposium on Zinc Base Die Castings. The list of speakers and their topics follow:

MR. R. F. BURNS, New Jersey Zinc Sales Company, Chicago, Ill., "Manufacturture of Zinc Base Die Castings"

MR. G. F. NIXON, Fisher-Ternstedt Division, General Motors Corporation, Detroit, Mich., "Polishing and Buffing"

MR. HENRY STROW, MacDermid, Inc., Waterbury, Conn., "Cleaning of Die Castings"

MR. R. M. WAGNER, Guide Lamp Division, General Motors Corporation, Anderson, Ind., "Electroplating of Die Castings"

MR. LEE MORSE, Chrysler Engineering Laboratories, Highland Park, Mich. "Electrolytic Purification of Plating Solutions".

The Branch wishes to take this opportunity to thank publicly all those whose

splendid cooperation made this event a success.

The Dinner Dance was also well attended; 1,170 people enjoyed the dinner, the entertaining floor show, and the dancing.

G. Stuart Krentel,
Review Correspondent.

●

COLUMBUS BRANCH

Eighteen members and guests were present at the regular meeting on January 3 to hear Mr. Kenneth Tator of Industrial Lining Engineers give a very interesting talk on tank linings and rack coatings. The talk was composed largely of first-hand information and was of unquestionable value to all present. It was followed by a lively discussion.

A routine business session opened the meeting.

Cloyd A. Snavely,
Second Vice-President.

Society Publications in Libraries

According to our latest information, the Society's publications are now available in the following institutions. The ones marked with an asterisk are known to be equipped to supply photostatic copies of any article desired.

*The Library of Congress, Washington, D. C.
The Monthly Review, 1914–16, 1930, 1932—complete; 1931 incomplete
Proceedings, 1931, 1933, 1935—Complete

*The Free Library of Philadelphia, Logan Square, Philadelphia. Pa.
The Monthly Review, 1914—complete
Proceedings, 1914—complete (few pages missing 1921, 1923, 1935)

*The Enoch Pratt Public Library, Baltimore, Md.
The Monthly Review, 1915—complete
Proceedings, 1927, 1929–33, 1935—complete

Los Angeles Public Library, Los Angeles, Calif.
The Monthly Review, 1915—complete
Proceedings, 1927–28, 1930, 1932–33, 1935—complete

Grand Rapids Public Library, Grand Rapids, Mich.
The Monthly Review, 1915—complete
Proceedings, 1943—complete

Milwaukee Public Library, Milwaukee, Wis
The Monthly Review, 1914—complete

Carnegie Library of Pittsburgh, 4400 Forbes Street, Pittsburgh 13, Pa.
The Monthly Review, 1920—complete

James Jerome Hill Reference Library, St. Paul 2, Minn.
The Monthly Review, 1920—complete

Ohio State University Library, Columbus 10, Ohio
The Monthly Review, 1930, 1932, 1934-36 incomplete; 1937—complete
Proceedings, 1940—complete

*New York Public Library, 5th Avenue at 42nd Street, New York City
The Monthly Review, Sept. 1933—complete

John Crerar Library, Chicago, Ill.
The Monthly Review, 1937—complete

*Detroit Public Library, Detroit, Mich.
The Monthly Review, 1936 incomplete; 1937—complete

Public Library of Cleveland, Cleveland, Ohio
The Monthly Review, 1932—complete

Toledo Public Library, Toledo, Ohio
The Monthly Review, 1916–37 incomplete; 1938—complete

We hereby gratefully acknowledge receipt of back issues of The Monthly Review during the past month from the following:

Vic Miner Company, Toledo, Ohio
Crown City Plating Company through Los Angeles Branch
George B. Hogaboom, New Britain, Conn., Hartford Branch

Change in Date for the Milan Fair

Mr. John B. Erskine, Room 2251, 135 S. La Salle Street, Chicago 3, Ill., the U. S. Representative of the Fair, has announced that the date has been changed to September 12 to 27 from April 12 to 27 as given in the last issue of The Monthly Review.

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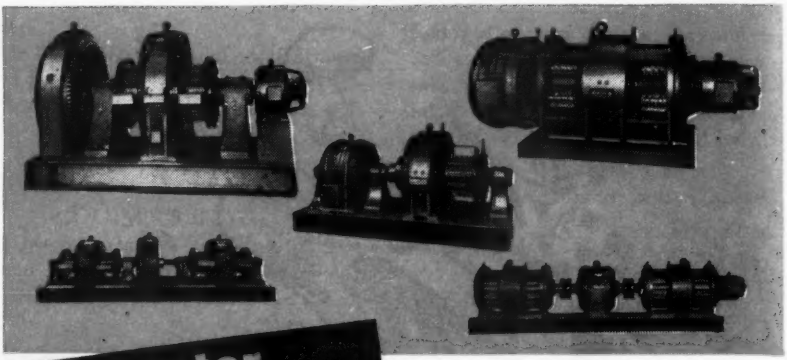

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By KENNETH M. HUSTON

Chairman, Program and Educational Committee

German Electroplating Industry

BRITISH INTELLIGENCE OBJECTIVES SUB-COMMITTEE. *Final Report* No. **429**, H. M. Stationery Office (1945); *Bull. Iron and Steel Inst.*, No. **129**, 76A (September 28, 1946).

A report on a team visit to electroplating plants in Germany examines the application of electrodeposition to war purposes and gives an outline of the German plating industry.

•

Identification of Electroplated Coatings

ANON. *Materials and Methods*, **24**, 673 (1946).

The examinations should proceed in the order given in a table: (1) Color and Appearance; (2) Scratch Test for Hardness; (3) Spot Test with Concentrated Nitric Acid; (4) Spot Test with Concentrated Hydrochloric Acid; (5) Chemical Identification.

Coatings included in the table are brass, cadmium, chromium, nickel, copper, gold, lead, platinum, silver, tin and zinc.

Before any tests are made, protective lacquer coatings must be removed completely by the use of a solvent, i. e., lacquer thinner. When making spot and other chemical identification tests for plated coatings, care must be taken to note that the reaction or color produced by the test is due to the coating and not to the basis metal. Thin or porous deposits may give false indications.

•

Some Principles and Methods of Surface Measurement

R. E. REASON. *Institution Mech. Eng. Proc.* **153**, War Emergency Issue No. 10, 335–337 (1945); *Metals Review*, **19**, 11 (Sept. 1946).

Progress in meeting industry's need for simple workshop instruments giving sensible measures of surface quality is impeded mainly by lack of sound experimental data on what really needs to be measured and on how accurately measurements should be made. A great deal of work will be required before general principles can be firmly established.

•

Determination of the Thickness of Anodized Layers on Aluminum and Aluminum Alloys

V. DUFFEK and A. VOLLMER. *Korrosion u. Metallschutz*, **18**, 37–41 (1942); *Br. Chem. Abst., C*, **5** (Mar. 1946).

The procedure of dissolving the coating in a mixture of aqueous ortho-phosphoric acid and chromic acid (found in preliminary experiments not to attack the metal appreciably) at 80° C and determining the loss

in weight or change in dimensions gave results agreeing to within 2 to 4% with metallographic measurements. This acid mixture is recommended for large-scale removal of anodized layers and layers produced by chemical means.

●

Measurement of Surface Roughness

C. TIMMS. *Metal Treatment*, **13**, 111–118 (Summer 1946); *Metals Rev.*, **19**, 11 (Sept. 1946).

Instruments are described with details of the range of roughness which each type can accommodate. There is need for correlation between the physical and geometrical aspects of a surface in order to determine the surface qualities which are of importance. Unit adopted for the measurement of surface roughness in British practice is the micro-inch, where 1 micro-inch = 0.000001 inch or 0.0254 μ.

●

Metal Treatment Processes Prior to Painting

A. R. KING. *Paint Mfg.*, **16**, (1946).

I. Light Metals (pp. 73–76): Methods for preparation of light metals, especially aluminum, are discussed with emphasis on adequate cleaning—II. Chromating and Phosphating (pp. 113–117): Chromate anodizing of aluminum and phosphate treatments of ferrous metals are detailed—III. Phosphating for Paint Bonding (pp. 217–228): Further discussion of phosphate treatment of iron with crystal types illustrated with photographs.

●

Surface Finishes for Aluminum

J. F. MASON. *Iron Age*, **158** (1946).

I. (pp. 40–43, Aug. 29): Details of bath composition, time, temperature and procedure in chemical treatments.—II. (pp. 50–53, Sept. 5): Discussion of oxide coatings, especially those applied by the Alzak and Brytal processes.—III. (pp. 66–69, Sept. 12): In methods of electroplating: the cleaning, pre-treatments, bath composition, plating time and temperatures, and post-treatments.

●

Determination of the Thickness of Chromium Deposits on Nickel by the Drop Test

E. S. SPENCER-TIMMS. *J. Electrodepositors' Tech. Soc.*, **21**, 79–90 (1946).

An investigation of the drop test was carried out in 1939-1940 to improve the technique, standardize the method, determine the influence of temperature, and examine commercially plated articles for thickness and distribution of deposit. A retaining ring for the drop is applied to the test piece with a glass compass. The applied material consists of about 45% bitumen, 45% rubber and 10% carnauba wax. Three distinct end points are described. Graphs are presented, as well as numerous illustrations showing the chromium plate thickness found on various articles. No direct comparison with the work of Blum and Olson is possible because acids of different sp. gr. were used. A recommended procedure is given, and a nomograph to be used with it.

●

Production of a Homogeneous Anodic Film on Aluminum and Its Alloys

J. HERENGUEL and R. SEGOND. *Rev. met.*, **42**, 258–265 (1945); *C. A.*, **40**, 4962 (1946).

Alumina film produced by anodic oxidation of aluminum and its alloys may form a uniform layer or may consist of two layers having greatly different structure and hardness. The type formed depends on how the electrolyte attacks the alumina. With a sulfuric acid electrolyte below a given critical temperature, the attack is limited to the outside surface and is uniform. It may cause only reduction of the film thickness. At higher temperature, the action pene-

trates locally into the film changing greatly its fibrous nature and compactness. Copper and aluminum impede the formation of the alumina film, zinc and magnesium facilitate it. Spatial diagrams illustrate the relation between film thickness, current density and temperature for aluminum, 6.5% aluminum-magnesium alloy and Duralumin.

●

Anodic and Organic Finishes

ANON. *Metal Progress*, **50**, 716, 718, 720, 722 (October 1946).

A brief review summarizing the work of some German investigations. Fischer and Budiloff suggest that the yellow tones produced by oxalic acid electrolytes is the result from some decomposition product of the oxalic acid. Another paper by the same authors reports an explanation for the superiority of bichromate sealing treatment to the effect that the excess bichromate locally reseals the damaged part of the exposed metal by its oxidizing effect. A third article by H. F. Sarx discusses the possibility of using lacquer as coating before working or drawing of sheet.

●

After-Treatment of Aluminum-Alloy Castings

E. CARRINGTON. *Light Metals*, **9**, 439-450 (1946).

A fairly detailed paper on various methods for finishing castings. Under mechanical treatments are listed scratch brushing, sand blasting, polishing, barrelling and burnishing. Chemical treatments include plating and anodizing as well as pre-cleaning. Painting and spraying are discussed briefly.

●

Abrasive Belt Grinding

ANON. *Steel*, **119**, 78–81, 120–121 (July 29, 1946).

The Minnesota Mining and Manufacturing Company, St. Paul, Minn., has developed special machines for use with abrasive belts which have contributed important improvements in grinding and polishing operations, increasing production and bettering the quality of the finish. This is the first of two articles discussing some of the factors governing the development of this method of grinding.

After considerable experiment, it was discovered that for full scale production and more even finishes on stainless steel, a factory-coated abrasive belt, the full width of the sheet, was needed.

●

"Dry" Galvanizing; Effect of Aluminum Additions to the Zinc Bath

H. BABLIK. *Metal Ind.*, **68**, 487–489 (1946).

The main difference between "wet" and "dry" galvanizing is, according to the author, a difference in the aluminum content of the bath—in the "wet process" no more than 0.02%, in the "dry process", 0.2 to 0.3%. The article discusses in detail various solutions and their applications. The "dry process" is used mainly for the galvanizing of flat sheets.

●

Industrial Electrolytic Polishing

R. HALUT and P. ROCQUET. *Galvano*, No. 111, 8 (1946).

Electrolytic polishing gives an absolutely smooth surface free of oxide inclusions often present on apparently smooth surfaces obtained by ordinary mechanical polishing. It constitutes an excellent preparation of a surface for electrodeposition, especially for bright plating. Electrolytic polishing before the last stages of rolling or drawing gives a more perfect and brilliant surface. The chief requirement for the application of electrolytic polishing is a homogeneous alloy containing few impurities.

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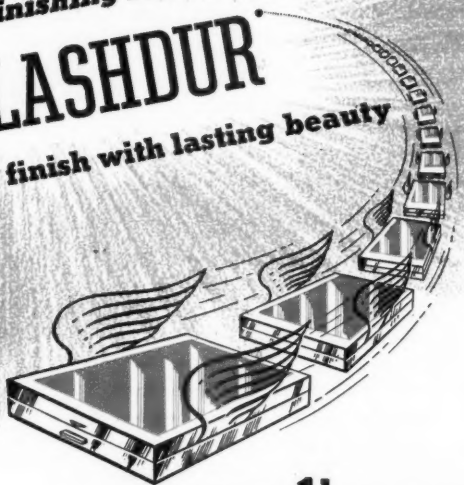

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By GEORGE B. HOGABOOM

Consultant, New Britian, Conn.

No. 2,414,923, January 28, 1947—Metal Cladding by Spraying—Clement Batcheller.

2 Claims.

CLAIM 1. The method of cladding the surface of an elongated metal product, such as a bar or strip, with chrome-nickel, austenitic stainless steel which comprises roughening said surface, continuously moving said product lengthwise thereof, electrically heating said moving product approximately to hot rolling temperature in a non-oxidizing atmosphere by inducing high frequency currents therein, spraying a coating of said steel on the roughened surface of said moving product while hot and still in said non-oxidizing atmosphere, rapidly cooling said coated product, whereby the steel coating thereon is rendered soft and workable, and thereafter hardening said coating and compressing into a dense, smooth-surfaced mass by cold rolling said product.

No. 2,414,438, January 21, 1947—Electrodeposition of Selenium—Mortimer C. Bloom, assignor to Federal Telephone and Radio Corporation.

4 Claims.

CLAIM 1. In a process for forming an adherent fine-grained coating of metallic selenium upon an electro-conductor surface, the step that comprises electrodepositing the metallic selenium upon said electro-conductor as the anode of a pair of electrodes in an aqueous alkaline solution that comprises essentially a selenide selected from a class consisting of ammonium, alkali metal, and alkali earth metal selenides.

No. 2,413,853, January 7, 1947—Article Washing Machine—Eric R. Zademach and William D. Clark, assignors to Metal-Wash Machinery Company.

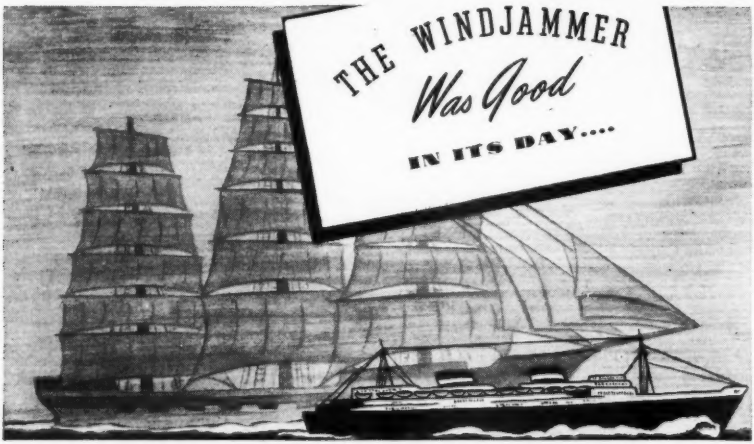
15 Claims

CLAIM 1. Apparatus for fluid treatment of articles comprising a treatment chamber provided with spaced double walls forming a common vapor discharge passage on two sides of the chamber, the inner wall having a free lower edge throughout a substantial part of the two sides of the treatment chamber, the outer wall extending downwardly beyond the inner wall to form a passage inlet between the walls, and a vapor discharge outlet construction at the upper part of the vapor discharge passage adapted to lead the vapors out of said passages and away from said chamber.

No. 2,414,090, January 7, 1947—Bath for and Electrolytic Treatment of Magnesium and Magnesium Alloys—Robert W. Buzzard.

6 Claims.

CLAIM 1. A method of producing corrosion resistant coatings on a class of metals consisting of magnesium base alloys, comprising subjecting the metals to an anodic action in an electrolytic bath consisting essentially of an aqueous solution containing a water soluble salt of chromic acid, a water soluble phosphate and magnesium fluoride, the *p*H of the solution being adjusted to and maintained within the range of *p*H 3 and *p*H 5.



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By DR. HAROLD J. READ
Associate Professor of Metallurgy
The Pennsylvania State College

PROTECTIVE AND DECORATIVE COATINGS, VOL. V, Analysis and Testing Methods. Edited by Joseph J. Mattiello, IX + 662 pages. John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $7.00.

The fifth volume in this series of books relating to the paint and varnish industry follows the general pattern set by its predecessors. Each of the chapters is the work of one or more specialists in the field concerned. In general, the material has been well organized and clearly presented with adequate references to the pertinent literature. There is ample evidence of careful editing and skilled book-making.

The first chapter, by R. W. Stafford and E. F. Williams, deals with the analysis of resins. This complicated subject has been divided into parts so that the first half classifies resins on a structural basis and presents solubility characteristics, uses, and tables containing the most common physicochemical properties of resins selected to illustrate pertinent variations in the classes discussed. The second half of the chapter presents general analytical procedures which have been successfully employed by the authors.

T. F. Bradley and E. L. Kropa are responsible for the chapter on the analysis of drying oils. The manifold difficulties and problems which arise have led, as pointed out by the authors, "to a confused array of methods which have suffered from a superfluity of variations and refinements." In the present instance a very considerable amount of order has been projected into the chaos, and any technologist having an interest in drying oils will find this section most helpful.

The third chapter, on the laboratory testing of metal finishes, by S. E. Beck treats only of paints, varnishes, etc., and does not touch upon metallic coatings. It is a discussion of fundamentals and principles rather than a detailed presentation of testing procedures.

The spectral characteristics of pigments in the visual and infra-red bands form the subject matter of a chapter by V. C. Vesce. The first two parts of this section of the book describe the photographic and spectrophotometric methods of making measurements. The third part consists of illustrations of the spectrophotometric curves obtained from briquets of various pigments. There are 99 pages of these data with 181 reflectance curves, structural formulae of organic pigments, and reflectance integrations for the usual four bands for each pigment. A finding table is also included.

The final chapter, by T. G. Rochow and R. L. Gilbert, is entitled "Resinography," a term proposed by the authors for the graphic study of resins. The microscope is the principal tool of the resinographer, hence a very large portion of this chapter is devoted to a description of the equipment used in microscopy, the preparation of specimens, and the making of observations on resinous bodies. There is a great deal of information on the identification of constituents by methods involving microscopy. This is illustrated by numerous unusually fine photomicrographs.

In summary it should be emphasized that this book is not a laboratory manual or "cook-book" but an extended treatise on the problems encountered in the analysis of the materials concerned, and the methods used in dealing with these problems.

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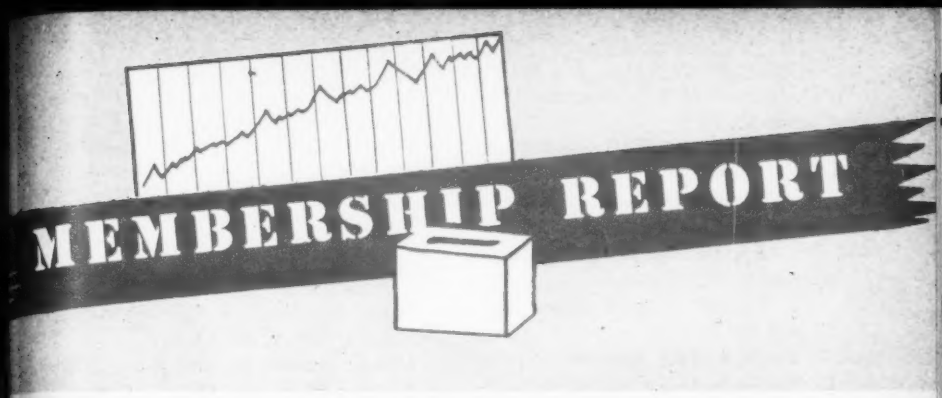

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John B. Capuano, The Udylite Corporation, 1651 E. Grand Blvd., Detroit 11, Mich.
Robert I. Carlson, 780 Westwood Drive, Birmingham, Mich.
Helen M. Casey, 785 University, Grosse Pointe, 30, Mich.
Paul D. Harper, 550 Albany St., Ferndale 20, Mich.
C. E. Morris, 4911 Catherine St., Dearborn, Mich.
Harry P. Pinson, Hannan Y. M. C. A., 10401 E. Jefferson, Detroit 14, Mich.
Frank E. Richards, 308 W. Cambourne, Ferndale 20, Mich.
C. Ed. Young, 18127 Bentler, Detroit 19, Mich.

GRAND RAPIDS BRANCH

Don J. Anders, 1615 Plainfield Ave. N. E., Grand Rapids 5, Mich.
John DeLucia, DeLucia Mfg. Company, 2710 Chestnut St., Toledo, Ohio
Bernard Kumko, 621 Third St. N. W., Grand Rapids 4, Mich.
James P. Reed, J. C. Miller Company. Grand Rapids, Mich.
Otto F. Szczepanik, 527 Houseman Ave., Grand Rapids, Mich.
Morris Tardiff, 796 Howard Ave., Holland, Mich.

JACKSON-LANSING BRANCH

Wesley G. Parry, 206-A Boulevard Building, Detroit 2, Mich.
Don L. Shepard, Box 142, Lennon, Mich.
Clarence L. Welch, 128 W. Wesley St., Jackson, Mich.

LOS ANGELES BRANCH

Edwin R. Calderon, 4700 Victoria Ave., Los Angeles 43, Calif.
Harry Meagher, 1826 Sunshine Ave., Norwalk, Calif.
Joseph L. Pifer, 1144 Arapahoe St., Los Angeles 6, Calif.
Charles R. Sansoni, 100 S. Arboles Ct., San Pedro, Calif.

MILWAUKEE BRANCH

Robert J. Racine, 1434 First Wisconsin National Bank Building, Milwaukee 2, Wis.
James Schueneman, 1718 Dugdale Rd., Waukegan, Ill.
Langley C. Ward, 305 Hamilton St., Racine, Wis.

NEWARK BRANCH

Louis M. Brown, 585 North St., Teaneck, N. J.
Emerson E. Dale, 277 Edgewood Ave., West Englewood, N. J.
Mario F. DiChiara, 536 Hamilton Rd., S. Orange, N. J.
Charles Gardella, 593 Broad St., Carlstadt, N. J.
Irwin Kempton, 4511 New York Ave., Union City, N. J.
Marvin Sims, 335 Market St., Paterson, N. J.
Leroy D. Vreeland, 412 N. Chestnut St., Westfield, N. J.

NEW YORK BRANCH

Robert E. Allison, 65 Park Terrace East, New York 34, N. Y.

Oscar Binder, 201 W. 88th St., New York 24, N. Y.
Leonard Carnevale, 213 E. 120th St., New York 35, N. Y.
William M. Cartright, 88-73 193rd St., Hollis 7, N. Y.
Sidney A. Lewis, 730 W. 183rd St., New York 33, N. Y.
Robert Solomon, 3039 Wallace Ave., Bronx 67, N. Y.

PHILADELPHIA BRANCH

Richard F. Blake, 3345 N. 21st St., Philadelphia 40, Pa.
Sydney Bull, 56 Bragg Rd., Handsworth, Birmingham 20, England
Ludwik Galuszka, Zadiele-Zywiec, Poland
High B. Webster, Harshaw Chemical Company, 12 S. 12th St., Philadelphia 7, Pa.
Howard L. Wright, Bourse Building, 4th and Ranstead Sts., Philadelphia 6, Pa.
S. R. Betteridge, Metalion Ltd., North Acton Rd., Willesden, London N. W. 10, England
William H. Sawyer, J. S. Wood Ltd., Central Plating Works, Hockley Hill, Birmingham 18, England
Earl J. Serfass, Chemistry Department, Lehigh University, Bethlehem, Pa.
Ralph W. Wirt, R. D. No. 1, Gilbertsville, Pa.

PITTSBURGH BRANCH

Edwin M. Barnes, Collins & Wright, Inc., 5509 Butler St., Pittsburgh 1, Pa.
Harry W. Kull, 84A Harper Drive, Turtle Creek, Pa.
Patrick J. Richey, 1734 Belleau Drive, Pittsburgh 12, Pa.

ROCHESTER BRANCH

John W. Dziminowski, 118 Cleon St., Rochester 5, N. Y.
Donald M. Groh, 105 Kenwood Ave., Rochester, N. Y.
Walter Vogt, Shuron Optical Company, 242 Andrews St., Rochester 1, N. Y.

ST. JOSEPH VALLEY BRANCH

Samuel J. Alfano, 610 E. Madison, Goshen, Ind.
H. E. Sherk, R. No. 4, Indian Lake, Dowagiac, Mich.

ST. LOUIS BRANCH

R. M. Garrison, Gardner-Denver Company, Quincy, Ill.
George E. Koderhandt, 1651 N. Charles, Belleville, Ill.

SAN FRANCISCO BRANCH

Carl W. Kuba, 1283 West Ave., Santa Rosa, Calif.

SOUTHEASTERN BRANCH

H. V. Johnson, 1385 Ormewood Ave., Atlanta, Ga.

SYRACUSE BRANCH

Vincent P. McConnell, 269 Whittier Ave., Syracuse 4, N. Y.

TWIN CITY BRANCH

A. S. Bathke, 490 N. Snelling Ave., St. Paul, Minn.

WATERBURY BRANCH

Henry E. Weiss, 21 Bradley St., Naugatuck, Conn.

REINSTATEMENTS

BUFFALO BRANCH

W. H. Kirlin

DAYTON BRANCH

Eugene Cotton

SAN FRANCISCO BRANCH

Albert Bell

TRANSFERS

John A. Turk from Chicago Branch to Cleveland Branch
G. Vlasaty from Chicago Branch to Milwaukee Branch
D. Gardner Foulke from Detroit Branch to Newark Branch
Heamon Castle from Grand Rapids Branch to St. Joseph Valley Branch
W. G. Sheane from Newark Branch to Cleveland Branch

John Guthrie from Newark Branch to Pittsburgh Branch
J. E. Rhoads from Syracuse Branch to Cleveland Branch
Harry Goldberg from Boston Branch to New York Branch
Alan Baker from Boston Branch to San Francisco Branch

RESIGNATIONS

BOSTON BRANCH
Edward Grinnell
Robert Magnuson

JACKSON-LANSING BRANCH
Richard R. Carper
T. W. Mack
H. A. Simonds
Victor Stephens

MILWAUKEE BRANCH
Herman Peterson

NEWARK BRANCH
Michael Fiorenza

ST. LOUIS BRANCH
Frank P. Boyle
Fred Zingerling
F. W. Weber

SAN FRANCISCO BRANCH
O. R. Olden, Jr.
O. P. Ergenbright

SUSPENSIONS

BOSTON BRANCH
Robert A. Canning
Elliot Charney
Aldo Berchielli
Henry J. Levesque
W. Kent Shockley
N. Z. Yao

CHICAGO BRANCH
J. E. Gaske
E. Woodmansee

JACKSON-LANSING BRANCH
John S. Hart

ROCHESTER BRANCH
Renata Silva

ST. LOUIS BRANCH
J. F. Davis

DEATHS

BOSTON BRANCH
John F. Nestor

DETROIT BRANCH
P. W. C. Strausser

WATERBURY BRANCH
Clinton W. Davisson

New A.S.T.M. Headquarters Building Dedicated

During the Spring Meeting and Committee Week held in Philadelphia, Pa., the *American Society for Testing Materials* dedicated its new Headquarters Building at 1916 Race Street. During the exercises in the afternoon of February 26, *Dr. G. H. Clamer*, the senior living A. S. T. M. Past-President, presented the Building to *Arthur W. Carpenter* who accepted it on behalf of the Society. Many present and past officers and directors of the Society, chairmen of technical and administrative committees were present along with invited guests representing other national associations and local institutions and groups.

A dinner was held in connection with the dedication at the Benjamin Franklin Hotel, the same evening. *Dr. T. G. Delbridge*, Past-President, was the Toastmaster, and there were short addresses by *Dr. George W. McClelland*, President of the University of Pennsylvania; *R. T. Nalle*, President of the Franklin Institute, and *Walter Edge*, President of the Engineers' Club of Philadelphia. *Dr. E. U. Condon*, Director of the National Bureau of Standards, delivered the principal address.

The Headquarters Building houses the Society's present staff of forty-two employees headed by Executive Secretary *C. L. Warwick*. It was made possible by contributions from the Society members, the total now having reached about $160,000.

MEMBERSHIP CHART

BRANCH	Membership May 1, 1946	New Members	Net Change in Membership	Per cent Net Change
FIRST GROUP				
NEW YORK	201	49	+42½	+21.1
PHILADELPHIA	170	39	+30½	+17.9
BRIDGEPORT	124	26	+21½	+17.3
CHICAGO	359	53	+35½	+ 9.9
TORONTO	131	12	+ 7	+ 5.3
CLEVELAND	177	29	+ 9	+ 5.1
LOS ANGELES	181	30	+ 8	+ 4.4
WATERBURY	128	10	+ 4	+ 3.1
BOSTON	168	16	+ 5	+ 3.0
HARTFORD	134	17	+ 2½	+ 1.9
NEWARK	243	20	+ 2½	+ 1.0
DETROIT	440	38	−24½	− 5.6
SECOND GROUP				
PITTSBURGH	97	26	+25½	+26.3
GRAND RAPIDS	116	20	+18½	+15.9
INDIANAPOLIS	90	10	+12	+13.3
ST. LOUIS	122	15	+10	+ 8.2
SPRINGFIELD	82	6	+ 5½	+ 6.7
BUFFALO	87	6	+ 5½	+ 6.3
MILWAUKEE	120	15	+ 4½	+ 3.7
BALTIMORE-WASH.	114	5	+ 3½	+ 3.1
PROV.-ATTLEBORO	122	16	+ 3½	+ 2.9
ROCHESTER	97	4	+ 2	+ 2.1
DAYTON	87	7	.....	.....
NEW HAVEN	110	2	− 3½	− 3.2
SYDNEY	82	11	−14	−17.1
JACKSON-LANSING	85	4	−34½	−40.6
THIRD GROUP				
ST. JOSEPH VALLEY	60	19	+22½	+37.6
ADELAIDE	37	12	+12	+32.5
TWIN CITY	72	25	+20½	+28.4
ROCKFORD	53	9	+ 9	+17.0
SYRACUSE	64	12	+ 7½	+11.7
SAN FRANCISCO	64	11	+ 2½	+ 3.9
MELBOURNE	59	..	+ 1	+ 1.7
COLUMBUS	34	5	.....	.....
LANCASTER	38	..	− 1	− 2.6
MONTREAL	61	6	− 2½	− 4.1
CINCINNATI	58	1	− 2½	− 4.3
TOLEDO	60	2	− 4	− 6.7
TOTAL A. E. S.	4,527	628	+288	+ 6.4

Membership Feb. 15, 1947 4,815

Enthone Emulsion Cleaner EC-75 at work. Emulsified oil, grease and solid dirt is carried away in water.

A powerful new emulsion cleaner

SAFE for the plating room

New pre-soak does not contaminate alkali cleaners and is not offensive to operators

ENTHONE EMULSION CLEANER EC-75 is a new development in emulsifiable solvent cleaners, possessing the solvent powers of aliphatic hydrocarbons and, at the same time, disperses instantly in water.

One of the important advantages of EC-75 is that it does not HARM alkali cleaners when dragged into them. In fact, the efficiency actually increases.

Emulsion Cleaner EC-75 is used as a pre-soak to remove oil, grease, buffing compounds and solid dirt from all types of metal. Its great penetrating power insures thorough cleaning of recesses and crevices.

After soaking, the work is rinsed with running water or a water spray and then is cleaned chemically and physically with only a short treatment in an alkali cleaner. By virtue of the solvent action and penetrability of EC-75, contaminants which resist alkali cleaning alone, are quickly removed.

EC-75 supersedes naphtha, kerosene or chlorinated solvents in the cleaning cycle. It has a high reservoir of emulsifiers and penetrants to enable it to withstand heavy contamination from oil and dirt. EC-75 contains no fatty acid soaps and therefore eliminates rinsing difficulties.

12 points for Platers

1. Not irritating to throat or hands.
2. Leaves no objectionable odor.
3. Outlasts simple solvents.
4. Not contaminated by oil, grease, or buffing compounds.
5. Does not jell on standing, or clot when rinsed.
6. Self-dispersing and quick rinsing.
7. Does not contaminate ALKALI cleaners.
8. Safe for ALL metals.
9. Removes oil, grease, dirt and pigmented drawing compounds from crevices and corners.
10. Speeds the cleaning of steel and avoids alkali cleaning for phosphate treatments, blackening or organic finishing.
11. Ideal — a must — for pre-cleaning zinc base die castings before plating.
12. Operates at room temperature 70-90° F.

Enthone EMULSION CLEANER EC-75

ENTHONE, INC. Metal Finishing Chemicals. 442 Elm Street, New Haven 2, Conn.

INDUSTRY NEWS

EXPERIENCED MAN AVAILABLE

Available after April 1: Graduate M.Sc. from nationally recognized college. Fifteen years' varied experience in electroplating field; control, research, supervision of large installations, sales. Would greatly prefer West Coast or the Southwest. I like sales and am well qualified to handle anything connected with the electroplating industry, either in a supervisory capacity in production, or in sales of equipment or supplies to the metal finishing trade. Married, 36 years old, Protestant.

Send replies to MR-3A, The Monthly Review, P. O. Box 168, Jenkintown, Pa.

Hammond Machinery Announces Improved Backstands

Improvements in the design of the *No. 3 Backstand* are announced by *Hammond Machinery Builders, Inc.*, Kalamazoo 54, Mich.

The primary change is in the pulley which is now of aluminum alloy construction. This pulley is mounted on sealed precision ball bearings and, being very much lighter than the original fiber pulley, no difficulty is experienced in keeping the abrasive belt on it and the contact wheel in starting and running. Also, the face of the pulley does not load up with metal and composition and its life is greatly extended.

A similar improvement is made in the *Hammond No. 4 Two-Pulley Backstand.* For further information write for Catalog 55, which illustrates the complete line of Hammond Polishing and Buffing machinery.

Job Shop Operations

The Masters' Electro-Plating Association, 123 William Street, New York City 7, N. Y., in its Monthly Bulletin for January advises that the rate of operation among its members during the month of January was 76% as compared to 79% for December and 67½% for January, 1946. Among the causes for decrease are mentioned: a normal January let-down, the inability of customers to obtain raw materials, and a reaction from the excessive rises in the cost of foods, soft goods and luxuries.

A review of business developments during 1946 shows that a high in the rate of operations was reached in October, namely 83%. On the whole, business has been active during the year except for the costume jewelry and the lamp trade both of which declined substantially. Profits, however, have not been satisfactory because of rising costs of labor and materials. Skilled labor has been short, especially polishers. Material shortages have been very bad throughout the year, particularly in cadmium, buffs, acids, alkalis, chromium chemicals and copper wire.

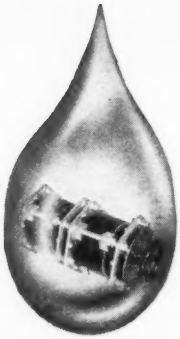
•

Unique Gift at Platers' Banquet

The Annual Banquet of the *Masters' Electro-Plating Association* of New York was held on Saturday, January 18, 1947 at the Park Central Hotel, New York City. Approximately 160 people attended. The feature of the evening was a presentation of a model of a plating barrel to *Joseph F. Brust*, President of Brust Brothers, Brooklyn, in recognition of his loyal and tireless service to the electroplating industry. At the same time, orchids were presented to *Mrs. Brust* and *Miss Bessie Siegel* (*Mrs. Norman J. Young*), in recognition of their aid to the firm.

The model was made entirely of brass and

this oil seal means

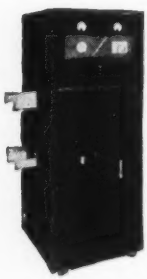


Better Plating

In the fume laden atmosphere of a plating plant, the oil sealed control unit of the R-A Selenium Rectifier assures protection of vital parts. This protection against corrosion assures continued accuracy and longer service. Combined with thermostatically controlled internal forced cooling, this feature allows R-A Controls to be placed right beside the tanks they serve.

Standard units available for immediate delivery. Write us today for data bulletins and the name of your nearest dealer.

Consider These Advantages:



1. Continuously variable stepless voltage control sealed in oil.
2. No lag in starting.
3. Adaptable for remote control.
4. Constant efficiency with varying loads.
5. No standby losses when not under load.
6. Minimum use of floor space and low installation cost.
7. Stability to withstand sudden overloads.
8. Internal forced cooling.
9. Thermostatic and circuit breaker protection.

Rectification for Every Application

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Sales Engineers Located in Principal Cities

Manufacturers of the most complete line of standard Selenium Rectifiers

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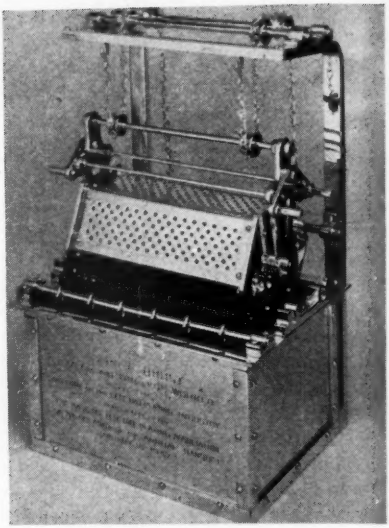
Selenium Rectifiers



plated all over with a heavy coating of gold. The model was made in the shop of one of the members of the Association, the *National Chromium Corporation*, 34 Hubert Street, New York, N. Y. The gold plating was done by *Edward Fascher*, 473 W. Broadway, N. Y., another member of the same organization.

This presentation continued a custom which was begun before the war. In 1939 a dinner was held in honor of the late *Philip Sievering*, signalizing his fiftieth year of continuous business operation. Mr. Sievering was presented with a gold-plated model of a plating tank. The war interrupted these celebrations, but they were resumed last year with the presentation of an engraved plaque to *Walter Plumacher*, of R. Plumacher & Sons, 344 E. 59th Street, New York City, for his services to the industry.

The model presented to Mr. Brust is an outstanding example of the electroplaters' art which made it peculiarly suitable as a gift to an electroplating firm.

•

Wyandotte Chemicals Appoints Weller To Head Market Research

Paul Weller, effective March 1, will become Assistant Director of the Market Research

Department of *Wyandotte Chemicals Corporation*. *Melvin E. Clark*, formerly in charge, will become a manager in the Sales Department of the Michigan Alkali Division.

Mr. Weller has been an analyst in the Market Research Department of Wyandotte Chemicals since 1945. Before joining Wyandotte he did engineering work for Goodyear Tire and Rubber Company. During the war he assisted in perfecting the engine mounts for the B-29 and the B-17. He has completed graduate work at Ohio State University and has compiled market research figures for other national organizations.

During the past year, Mr. Weller has been active in making field surveys of the industries served by the J. B. Ford Division of Wyandotte Chemicals. He will continue his activities along this line in addition to assuming further responsibilities in enlarging the scope of the Market Research Department.

•

New Enthone Spot Enamel Stripper

Enthone, Inc., Dept. MR, 442 Elm Street, New Haven, Conn., has developed a new spot enamel stripper designated as *Enthone Enamel Stripper S-45* for removal of synthetic enamel and other coatings. This stripper is recommended for stripping of enamel on large parts that cannot be immersed in a stripping solution.

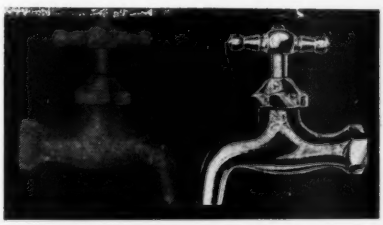
Stripper S-45 is a slightly viscous liquid that can be brushed, sprayed or applied by

Hammond of KALAMAZOO

BACKSTANDS
CONVERT
GRINDERS-POLISHERS
into high production
ABRASIVE BELT UNITS

Hammond Variable Speed Polishing Lathe and No. 3 Backstand installation.

Hammond Machinery Builders
1613 Douglas Ave. • Kalamazoo 54, Mich.



NEW IMPROVED
LUSTREBRIGHT
BRIGHT NICKEL PROCESS
Produces Lustrous Adherent Nickel Deposits. Ideal Base for Chromium.

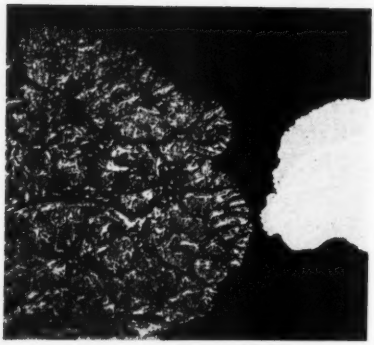
No color buffing • No re-cleaning • No re-racking • No special solutions or changes in equipment required • Merely add to cold nickel solution, still or mechanical • No extra equipment • Easy to control • Low in cost • Will not cause plate to peel, become brittle or produce streaky deposits.

Guaranteed not to harm Nickel Solutions

Illustration shows unbuffed deposits before and after Lustrebright.

Write for complete information.

W. C. BRATE COMPANY
Established 1860
18 MARKET ST. ALBANY, N. Y.



dipping to the work to be stripped. It contains a non-waxy evaporating retardent that keeps the stripper on the work until stripping action is completed. Stripping is accomplished by a wrinkling action so that the enamel can be brushed, wiped or, scraped off. No waxy residue is left to interfere with adhesion of subsequently applied finishes.

The stripper is stated to have very fast action on most synthetic enamels as well as certain nitrocellulose coatings. It is not satisfactory for linseed oil paints, phenol-formaldehyde enamels or vinyl type coatings. Modified urea-formaldehyde, melamine, and alkyd coatings are rapidly stripped. The stripper has no harmful action on metals, plastic, or wood, it is said.

It is suggested that samples of work be sent to the manufacturer for laboratory stripping tests. Literature furnished on request.

•

Hubert Royer Heads U. S. Chemical Stoneware Sales

The appointment of *Hubert Royer* as Sales Manager of the *Chemical Stoneware Division* of *The U. S. Stoneware Company*, is announced by *Howard Farkas*, Vice-President and General Sales Manager of The U. S. Stoneware Company, and its various divisions.

Mr. Royer comes to U. S. Stoneware from General Ceramics and Steatite Corporation. In his twenty-seven years as a Sales Engineer for General Ceramics, he has built an industry-wide reputation both as a Chemical

FOR SALE

THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS, WITH FULL CONTROL EQUIPMENT:

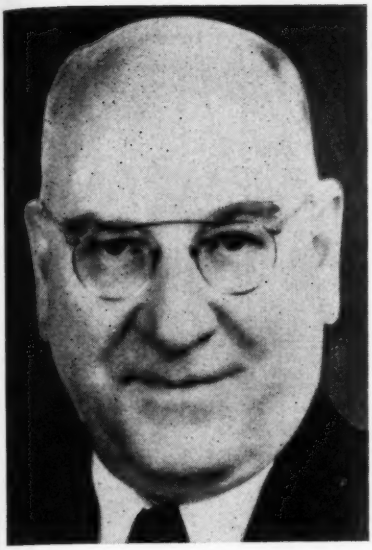
1—15,000/7500 AMPERE, 6/12 VOLT, **COLUMBIA ELECTRIC COMPANY,** Latest Design Unit, with Separate M. G. Exciter.
1—5000/2500 AMPERE, 6/12 VOLT, **CHARLES J. BOGUE ELECTRIC COMPANY,** Interpole Design—Separately Excited.
1—5000 AMPERE, 3/8 VOLT, **JANTZ & LEIST ELECTRIC COMPANY,** Interpole Design—Separately Excited, Single Commutator.
1—4000/2000 AMPERE, 6/12 VOLT, **HANSON & VAN WINKLE COMPANY,** Compound Wound, Separately Excited.
1—2500/1250 AMPERE, 6/12 VOLT, **HANSON & VAN WINKLE COMPANY,** Shunt Wound, Separately Excited.
1—2000/1000 AMPERE, 10/20 VOLT, **COLUMBIA ELECTRIC COMPANY**—25° Unit, with Synchronous Motor Drive.
1—2000/1000 AMPERE, 6/12 VOLT, **HANSON-MUNNING**—40° Unit, with Synchronous Motor Drive.
1—1500/750 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS COMPANY**—Separately Excited—Ball-bearing design.
1—1500 AMPERE, 40 VOLT, **HANSON-VAN WINKLE-MUNNING COMPANY**—practically new—Synchronous Motor Drive—for ANODIZING—with Automatic Controls.
1—1500/750 AMPERE, 12/24 VOLT, **CHANDEYSSON ELECTRIC CO.** Unit. Synchronous Motor Drive. Direct Connected Exciter.
3—1000/500 AMPERE, 6/12 VOLT, **CHARLES J. BOGUE ELECTRIC COMPANY**—Practically New—Separately Excited.
1—750/375 AMPERE, 6/12 VOLT, **HANSON & VAN WINKLE COMPANY**—Compound Wound.
1—500 AMPERE, 6 VOLT, **HANSON & VAN WINKLE COMPANY**—Compound Wound, Factory-built Unit.
10—100 AMPERE, 7½ VOLT, **HOBART ELECTRIC COMPANY**—SPECIAL LOT and SPECIAL PRICE FOR QUICK SALE.

SMALLER UNITS FROM 50 AMPERES UP, CARRIED IN STOCK AT ALL TIMES FOR IMMEDIATE SHIPMENT.

1—**MEAKER** SEMI-AUTOMATIC CONVEYOR UNIT. For Cyanide Plating. Excellent Condition. 20 ft. x 3½ ft. x 4 ft. deep.

ANODIZING MOTOR GENERATOR SETS—in stock for Sulphuric or Chromic Acid Solutions. Large Selection. Write for details.

M. E. BAKER COMPANY 143 SIDNEY STREET CAMBRIDGE, MASS.



and Ceramic Engineer. His broad experience in the application of chemical stoneware to the process industries makes him excellently fitted to direct the sales of this important division of U. S. Stoneware.

Mr. Royer will be located in the New York office of U. S. Stoneware, 60 E. 42nd Street.

•

Detrex Appoints McCracken Director of Research

Dr. W. L. McCracken has been appointed

For Precision Polishing

The DIVINE Compress Wheel

In Leather or Canvas

Easy to Balance
Remains True
Reduces Wheel Set-ups
Can Be Refilled
Made in 9 Densities
Diameters of 8" to 24"

Write for Bulletin M-471-R

Divine Brothers Company
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For Sale

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Slightly Used
BUFFS

LOOSE & SEWED
ANY QUANTITY
ALL SIZES

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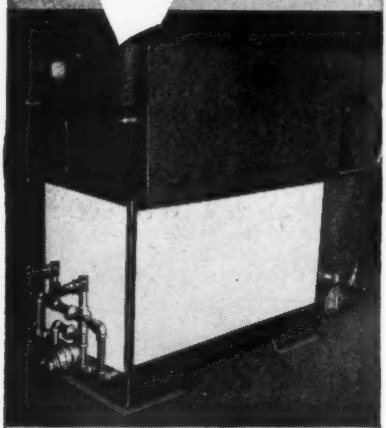
DETROIT (7) MICHIGAN

CHECK ON THESE
D'OILER
PLUS ADVANTAGES!



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2 JOB-ENGINEERED
3 ECONOMY OPERATED

FOR THOROUGH METAL CLEANING

The D'OILER Vapor Spray machine, illustrated above, can be used as a vapor-spray, or a straight vapor degreasing unit. Drain table recaptures dragout from basketed parts . . . all-around insulation reduces heat losses . . . exhaust duct on two sides safeguards operator . . . pump drive for standby solvent eliminates hand pouring.

Every D'OILER type is built to do a specific job . . . is designed with the "on-the-job experience" necessary to provide a degreaser that does the work, in the required volume, economically.

Our engineers will gladly advise on degreasing problems; your inquiries will receive prompt attention. Write today.

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PROCESS COMPANY
P. O. BOX 88, SOUTH ORANGE, N. J.

Director of Research and Manager of Alkali Manufacturing by *Detrex Corporation*, Detroit, Mich., according to an announcement by *A. O. Thalacker*, Vice-President and General Manager.

This promotion gives Dr. McCracken complete charge of chemical research and development engineering, as well as the chemical manufacturing operations carried on at the Detrex Hillview Plant. This covers activities in both industrial metal cleaning and dry cleaning divisions of the company. Dr. McCracken will serve under *C. F. Dinley, Sr.*, Vice-President in Charge of Research and Engineering.

Prior to the war, Dr. McCracken had charge of research and development for the third Detrex division, oil-extraction. He holds three degrees, B.S. (School of Mines and Metallurgy, University of Missouri), M.S. and Ph.D. (Iowa State) He is a member of the American Chemical Society and the Society of Oil Chemists.

•

Hanson-Van Winkle-Munning Announces New Material

The Hanson-Van Winkle-Munning Company, Matawan, N. J., announces a new material for producing a rich oxidized or "antiqued" effect on sterling and silver-plated products.

No electric current is required. The work is simply immersed in *Platin-Nig* solution, prepared according to simple directions. The parts are then highlighted for striking light-and-shadow relief.

Platin-Nig heightens the "quality look" of silver products. Full details are available on request.

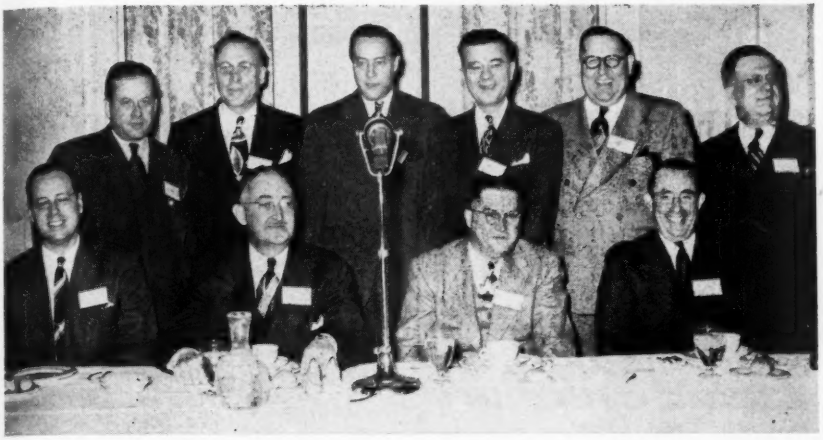
•

Pennsalt Names Tomlinson Easton Plant Superintendent

Ritner W. Tomlinson has been appointed Superintendent of the Easton, Pa., plant of the *Pennsylvania Salt Manufacturing Company*, it was announced by *Claude S. Beldin*, Pennsalt Production Manager.

Mr. Tomlinson previously was Plant Superintendent of the Pennsalt plant at Cornwells Heights, Pa., and the Greenwich plant in Philadelphia.

WYANDOTTE CHEMICALS REGIONAL SUPERVISORS



Wyandotte Chemicals Regional Supervisors who were guests at a recent staff meeting of the Research Department of their company. Standing, left to right: *Gordon Wood*, Midwestern; *P. S. Spencer*, Sales Manager Pacific Division; *G. T. Robinson*, Northwestern; *Gail Eldridge*, North Central; *Tom Jones*, Southern; and *C. W. Troxell*, Central. Absent when photo was taken were: *A. J. Bettelheim*, Eastern and *H. E. Ellison*, Eastern Canadian. *Carter B. Robinson*, Vice-President in Charge of Sales, J. B. Ford Division, is seated at the extreme right. *Dr. Thomas H. Vaughn*, Director of Research, is seated at the extreme left

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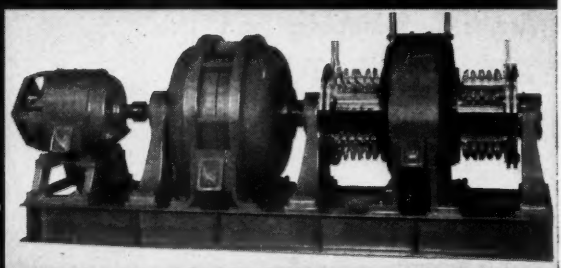

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Udylite Adds Two Newcomers to Sales Organization

James E. Fitzgerald and *Harvey E. Zens, Jr.*, have just joined *The Udylite Corporation's* sales organization and are assigned to the Detroit office.

Fitzgerald, a native Detroiter, who served during the war in the Coast Guard, formerly attended Notre Dame and both Libbey Owens' and the Ford Trade Schools. He has been associated with Plymouth Motor Car Company, Nicolay Dancey and Howe Martz Glass Company.

Zens, also a native Detroiter, who served as a Captain in the Army Air Corps during the war, formerly attended Albion College

and Wayne University. He has been associated with Dodge Motor Company, Carboloy Company and Meier Brass and Copper Company.

•

New Surface Treatment for Aluminum

American Chemical Paint Company, Ambler, Pa., has developed a new surface treatment for aluminum, the *ACP Alodine*, which is claimed to provide high corrosion resistance and a lasting bond for finishes.

Following precleaning, draining and rinsing which may or may not be necessary, depending on the condition of the aluminum surface, the work is treated by simple immersion in or spraying with Alodine solution, and drained. Parts of which are not to be painted are then dried at a high temperature while parts that are to be painted are rinsed, drained, given a warm acidulated rinse, and low-temperature dried.

Details may be had by writing to the company for Technical Service Data Sheet 7-16-100-9.

•

United Chromium, Limited, Formed in Canada

United Chromium, Limited, a subsidiary of *United Chromium, Incorporated*, has been formed to meet the increasing demand in Canada for "Unichrome" processes and materials. This new company will handle all of United Chromium's organic coatings for product finishing and industrial maintenance as well as their electroplating processes and materials. Offices are located at 15 Emily Street, Toronto, Canada, where *James Guffie* will be in charge as Manager.

Mr. Guffie, who was with United Chromium, Incorporated, for eighteen years, is well known in Canada. For the past eight years he has worked in close cooperation with Canadian industry as a service engineer for United Chromium, Incorporated. In addition to his new managerial duties for United Chromium, Limited, Mr. Guffie will continue to render technical assistance to licensees of United Chromium, Incorporated.

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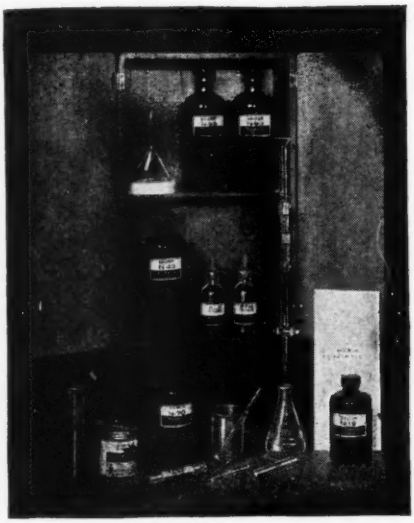

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